Model 8174
HF Monitor Receiver
Operating and Service Manual

0040-8174-15001, Rev. M

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1. GENERAL INFORMATION

1.1 Introduction

1.1.1 Scope

This manual provides the interface, installation, theory of operation and periodic maintenance instructions for the TCI Model 8174 HF Monitor Receiver (further referred to as the Receiver). For a description of the operation of the Receiver via the Virtual Control Panel (VCP), refer to the VCP Manual, Appendix E.

✍ **NOTE:** *The contents of this manual, including specifications, are subject to change without notice.*

1.1.2 Sections

The information in this manual is presented in eight sections. Section 1 provides a brief description of the equipment and operating specifications. Unpacking instructions, cabling data, and installation instructions are included in Section 2. Section 3 provides operating instructions for the Receiver. Section 4 explains the theory of operation for the Receiver. Section 5 describes preventive maintenance procedures for the equipment. Section 6 describes the configuration and firmware options of the Receiver. Section 7 is the interface protocol used in the Receiver. Section 8 presents the top level Illustrated Parts Breakdown, including parts lists and wire lists. Electrical drawings, including schematics and wiring diagrams, are grouped together at the end of the manual.

1.1.3 Abbreviations

This manual uses abbreviations found in "Military Standards Abbreviations for Use on Drawings and in Specifications, Standards and Technical Documents", MIL-STD-12D, whenever possible.

1.2 General Description

1.2.1 Introduction

The Model 8174, shown in Figure 1-1, is a general purpose, HF Monitor Receiver. This Receiver provides digitally demodulated and filtered audio signal outputs and, as an option, a digital panoramic display of the 6 kHz bandwidth. The 8174 Receiver chassis accommodates a single HF Receiver in a 1.75-inch high, 19-inch wide rack mount enclosure. The Receiver consists of five modules: a receiver module, a demodulation/control module, a synthesizer module, a power supply module and a DC power filter.

1.2.2 General Features

The Receiver provides digital filtering and demodulation of AM, CW, LSB, USB and ISB radio signals in the frequency range 1.5 to 30 MHz at a frequency resolution of 1 Hz. Frequency ranges at the lower end of the spectrum down to 10 kHz are available as an option. A BFO adjustable over ±8 kHz in 1 Hz steps is provided for CW demodulation mode.

Figure 1-1 8174 HF Monitor Receiver

The Receiver includes six preselection filters located in the receiver module:

1.5–3.0 MHz
3.0–5.25 MHz
5.25–8.5 MHz
8.5–13.25 MHz
13.25–20.0 MHz
20.0–30.0 MHz.

The standard demodulation bandwidths are:

0.3 kHz
0.5 kHz
1.0 kHz
2.2 kHz
2.5 kHz
2.7 kHz
3.0 kHz
3.1 kHz
3.2 kHz*
3.6 kHz*
4.0 kHz*
6.0 kHz.

*Additional bandwidths only available with “Dual-DSP” version of receiver.

The Receiver features one manual and four automatic gain control modes. Receiver gain control (digital AGC) covers an RF input signal range from –120 to 0 dBm. The digital AGC is further augmented by an automatic audio level control (ALC) in the DSP demodulation which maintains the audio output at constant amplitude (±1 dB). The four selectable AGC modes are optimized for AM, SSB voice, continuous data, and burst data. In addition, a selectable audio squelch control is provided with a range –126 to 0 dBm.

1.2.3 Frequency Scan

The Receiver has a versatile built-in frequency scanning capability. The operator can program the Receiver to scan either a discrete frequency list, or over a group of frequency ranges. The scan list can be set up with up to 100 discrete frequencies or 200 frequency bands (with start/stop frequencies specified). Also, the scan can be programmed with a combination of discrete frequencies and bands. In addition, up to 100 lock-out frequencies can be programmed to skip frequencies within scanned bands. If a signal is detected whose amplitude is above the scan threshold, the scan will stop and momentarily hold on that frequency. The scan rate (dwell time per frequency) and hold time (holding time after signal detection) can be programmed over a wide range of values.

1.2.4 Remote Control

There are no front panel controls on this model of the Receiver except for the POWER ON/OFF switch as shown in Figure 1-1. The unit was designed to be remotely operated under computer control. Consequently, all Receiver functions are remotely controllable via a serial interface or a serial bus. This feature allows the Receivers to be installed in locations separated from the operator location.

There are two options available for controlling the Receiver.

1. Through the TCI provided software package “Virtual Control Panel”, or VCP. The VCP package is a WINDOWS®-based program that allows remote control of up to thirty-one 8174 Receivers on a PC equipped with RS-232 or EIA RS-485 serial interfaces. The VCP software package includes the source code for user modification to suit specific needs.
2. Through the development custom software (see remote interface protocol in Section 7 of this manual) to control as required by the user.

1.3 Equipment Required but not Supplied

The user must supply the interconnecting cables (see paragraph 2.5 for additional information about interconnect cabling):

1. Between RF source and the Receivers RF input (coax, 50 ohm).
2. Computer interface connection (RS-232 or RS-485 from external computer to the Receiver).
3. Audio connection (Receiver balance line or unbalanced speaker audio output).
4. Between external reference 10 MHz and the Receiver 10 MHz input (coax, 50 ohm).

For operation with the VCP software package, the user must supply a PC-compatible computer running in a WINDOWS® environment. A 3.5-inch diskette drive is required to install the VCP software.

1.4 Publications

There are two publications describing the operation and service of the Model 8174 HF Monitor Receiver:

Title	Manual No.
Model 8174 HF Monitor Receiver, Operating and Service Manual	0040-8174-15001
Operating Manual, Model 8074/8174 Virtual Control Panel	0040-8074-15003

1.5 Specifications

Table 1-1 lists the technical specifications and tested performance characteristics of the Model 8174 Receiver.

Table 1-1 Model 8174 Receiver Specifications

Configuration:	Remotely controlled, modular single-channel internal Receiver in a 1U x 19-inch enclosure. The chassis includes a power supply with DC power filter and a single channel Receiver. A single channel Receiver consists of three circuit boards: receiver, synthesizer, and CPU/DSP.
Receiver topology:	Synthesized, triple conversion superhet. All RF tuning determined by 1st LO. Direct digital demodulation of 3rd IF output.
Frequency range:	1.5–30 MHz.
Tuning resolution:	1 Hz.
Demodulation modes:	AM, LSB, USB, ISB, and CW.
Bandwidths:	0.3, 0.5, 1.0, 2.2, 2.5, 2.7, 3.0, 3.1, 3.2, 3.6, 4.0, 6.0 kHz (Up to 48 bandwidths possible).
BFO:	Digital synthesis, ±8 kHz, 1 Hz resolution, CW mode only.
Frequency synthesis:	All LOs are fully synthesized and directly referenced to a common 10 MHz frequency reference. Low noise, “Fractional N” synthesizer for 1st LO. Tuning accuracy determined by frequency reference.
Frequency reference:	
Internal:	10 MHz TCXO, adjustable to 1 PPM accuracy, with 10 PPM stability (0° to 50°C), long term aging less than 3 PPM per year.
External:	10 MHz, 1 Vrms (0.5–1.5 Vrms range) into 50 ohm.
Frequency reference output:	10 MHz, ≈ 0.5 Vrm into 50 ohm.
Frequency change response time:	10 millisecond max after receipt of tuning command to settle to within ± 10 Hz for any size frequency step.
Synthesizer phase noise:	–85 dBc/Hz at 100 Hz offset –90 dBc/Hz at 1 kHz offset –95 dBc/Hz at 10 kHz offset –105 dBc/Hz at 50 kHz offset

Table 1-1 Model 8174 Receiver Specifications	
	–120 dBc/Hz at 100 kHz offset –130 dBc/Hz at 200 kHz offset –140 dBc/Hz at 1 MHz offset.
Antenna input:	50 ohm, 2:1 VSWR typical (3.5 : 1 max).
Preselection:	Six, 3-pole bandpass filters, 40 dB minimum out-of-band rejection. 1.5–3.0, 3.0–5.25, 5.25–8.5, 8.5–13.25, 13.25–20.0, 20.0–30.0 MHz. (1.5–3.0 MHz filter can be changed to .01–3.0 MHz for special applications).
Max signal level:	Linear operation up to 0 dBm in-band input. Receiver will withstand up to +20 dBm input with no damage.
Nominal input signal level range:	0 dBm max to noise floor (–130 dBm in 1 kHz BW).
Front-end attenuation:	Digitally switched 12 dB electronic attenuator.
Noise figure:	15 dB max (14 dB typical), 3–30 MHz.
(front end attenuator off)	17 dB max (15 dB typical), 1.5–3 MHz.
Out-of-band intermodulation distortion (measured with two –6 dBm input tones above 3 MHz) 2nd-order intercept: 3rd-order intercept:	 +75 dBm, 1 MHz min. spacing. +30 dBm, 100 kHz min. spacing.
IF settling time:	1 ms typical (2.7 kHz bandwidth). Does not include synthesizer response time.
1st IF:	40.455 MHz, 15 kHz bandwidth crystal filter.
IF rejection:	75 dB min. (80 dB typical).
Image rejection:	80 dB min. (90 dB typical).
2nd IF:	455 kHz tuned IF with mechanical bandpass filter.
2nd IF bandwidth:	6 kHz standard (other bandwidths optionally available).
2nd IF selectivity:	2 : 1 (40 : 3 dB).
Ultimate rejection:	70 dB.
Gain control:	Digital, electronically switched IF attenuators operating on RF and 2nd IF stages, plus DSP-based amplitude scaling of audio output.
Gain Range:	130 dB range in 1 dB steps. For receiver module (RF/IF):120 dB range (12 dB in front end, 108 dB in 2nd IF), in 6 dB steps.

Table 1-1 Model 8174 Receiver Specifications	
AGC response:	15 ms attack, selectable release time constants: 'Fast' (50 ms), 'Medium' (0.2 sec), and 'Slow' (4 sec hang with 1 sec decay) including hang time. 'Slow Data' optimizes the 'Slow' response for burst data applications (fast, peak detecting attack with slow decay).
AGC threshold:	Adjustable from –120 dBm to 0 dBm.
RF input level measurement:	Digital report (via remote control interface) of RF input power.
Squelch:	Automatic muting of audio output when RF input power level drops below user-programmed level.
Squelch threshold range:	Adjustable from –126 dBm to 0 dBm.
3rd IF center frequency:	5.0 kHz (for standard bandwidth).
3rd IF output level:	2.0 volts p-p nominal into 1000 ohm.
3rd IF output headroom:	12 dB minimum above nominal.
Digital Signal Processor:	Single or optional dual TMS320 series Digital Signal Processor(s) provide FIR filtering of signal bandwidth, BFO, automatic leveling of audio output, and optional PAN adapter display, or optional demodulation and control functions.
DSP demodulation bandwidth:	300 Hz min to 6 kHz max depending on demodulation mode (for standard IF bandwidth).
DSP demodulation filtering:	FIR filters with 1.5:1 shape factor (60:3 dB typical).
DSP audio scaling:	40 dB range in 1 dB steps.
Audio outputs:	Two 600 ohm balanced Line Audio outputs (MAIN and AUX, or one for each sideband in ISB), plus one 8 ohm unbalanced Monitor Audio output. Monitor Audio features addressable On/Off switching of output which allows Monitor Audio outputs from many receiver channels to be bussed together to a common audio device (e.g., headphones). Selected audio from one of up to 31 bussed receiver channels can be individually selected through remote control interface.
Line Audio output:	0.77 Vrms nominal, (0 dBm) into 600 ohm. Internally adjustable down to –10 dBm nominal. Audio level is also externally programmable through the remote control interface.
Monitor Audio output:	250 mW into 8 ohm. Signal source for Monitor Audio externally selectable through remote control interface from Main or Aux Line audio outputs.
Calibrator (BITE):	–70 dBm ±2 dB, 500 kHz comb (1.5–30 MHz) relay-switched in place of antenna RF input.
Built-in test (BIT);	Automatic testing, of power supply, synthesizer, receiver, and DSP using internal test circuitry (BITE). Results are reported through the remote control interface. Continuous status of major errors available through front panel LEDs.

Table 1-1 Model 8174 Receiver Specifications	
Remote control:	ASCII serial data, RS-485 addressable interface, selectable from 300 to 19200 baud. Remote control lines for up to 31 receiver channels can be bussed together and connected to a single RS-485 remote controller. (Equipment can also be configured for use with RS-232/422 or MIL-STD-188-114 interface, suitable for remotecontrol from PC computers.)
Remote control address:	Rear panel DIP switch selection of address 01 through 31 for receiver channel. Remote commands are executed only by the receiver channel with DIP switch address matching the command address header.
Virtual Control Panel:	IBM PC- compatible application software running under Microsoft Windows® to provide local control and readout of all Receiver functions.
Frequency scans:	Automatic scanning of up to 100 discrete frequencies, or up to 200 bands (each band defined by Start and Stop frequencies). Up to 100 lock-out frequencies may be programmed to skip frequencies within scanned bands. Scans may include any combination of discrete frequencies and bands. Frequencies programmable to 1 Hz resolution. Scan increment (within a band) programmable from 1 Hz to 100 kHz step size. Scan dwell time programmable from 50 ms to 10 per frequency. Scan dwell times down to 10 ms per frequency available for receivers using optional rapid tuning digital (DDS) synthesizer.
AC line power:	Autosensing 115 or 230 VAC, 50-60 Hz, 30 watt max.
AC power switch:	Front panel rocker switch.
Cooling:	Convection.
Front panel indicators:	• DC POWER (green LED). Indicates DC power to internal modules is ON. • RUN (green LED). Indicates CPU/DSP is operating. • FAULT (red LED). Indicates synthesizer lock error.
Mounting:	EIA RS-310 19-inch rack mount. Enclosure includes threaded inserts on side panels for mounting rack slides.
Size:	1.75"h x 19"w x 23"d.
Weight:	11 lb. (5 kg.) Shipping Weight: 20 lb. (9.1 kg.)
Temperature range:	Operating: 0° to +50°C short term, +5° to +40°C long term and for optimum performance. Non-operating: –40° to +70°C.
Humidity:	0–95% Relative Humidity.
Altitude:	10,000 feet operating, 40,000 feet non-operating.

Table 1-1 Model 8174 Receiver Specifications	
Rear panel connectors:	
Antenna input:	BNC
Remote Control input:	15-pin High Density D (HDD-15S)
Audio output:	9-pin D/sub connector (DE-9P)
AC line power:	IEC 320/VI
10 MHz:	BNC
OPTIONS	
Frequency range:	0.01–30 MHz.
Frequency reference Internal:	
Premium:	10 MHz TCXO, adjustable to 1 PPM accuracy, with 1 PPM (0° to 50°C) or 0.5 PPM (15° to 35°C) stability, long term aging less than 1 PPM per year.
Low cost:	10 MHz XO, 100 PPM accuracy (0° to 50°C).
Frequency change response time (for premium synthesizer):	1 ms max after receipt of tuning command to settle to within $\pm$1 Hz for any size frequency step.
2nd IF filter:	3 kHz or 12 kHz bandwidth filter instead of standard 6 kHz 3 kHz filter provides greater sensitivity, selectivity, and dynamic range for applications not requiring ISB or full AM operation. 12 kHz provides greater bandwidth (at the expense of sensitivity, selectivity and dynamic range) for applications requiring wider demodulation bandwidths.
DSP demodulation bandwidths:	Custom filters of any bandwidth from 100 Hz minimum to 12 kHz maximum, e.g., optional CW bandwidths available in any odd multiples of 100 Hz.
IF output:	455 kHz 2nd IF (–40 dBm into 50 ohm) or 5 kHz 3rd IF (1 V into 1000 ohm).
Digital I & Q outputs:	DSP generated digitized quadrature-phase outputs of 3rd IF.
Pan display:	Internal FFT processor provides digital spectrum data of the 6 kHz bandwidth IF as an aid for tuning or examining received signal characteristics. Up to thirty, 128-point FFT transforms per second (50 Hz resolution over 6 kHz) with up to 60 dB in-band amplitude range.

2. INSTALLATION

2.1 Introduction

This section contains instructions for installing the Model 8174 HF Monitor Receiver and for making all necessary cable interconnections before putting the Receiver to use. Details on storage and reshipment are also included.

2.2 Unpacking and Inspection

2.2.1 Shipment

The Receiver is shipped from the factory in a fully assembled condition (except for interconnect cabling). For shipment, the unit is enclosed in a moisture resistant barrier material with desiccant and humidity indicator. The unit is then packed in a cardboard shipping box. The maximum weight of the equipment is approximately 11 lb. (5 kg). The shipping weight of the unit in the packing case is approximately 20 lb. (9 kg).

2.2.2 Unpacking

To unpack the Receiver, open the top of the packing box and lift the unit out of the case. Check all items against the packing list. The shipping container and associated packing material should be retained for possible use in reshipment or storage of the unit.

2.2.3 Claim for Damage

If the Receiver is mechanically damaged or fails to meet specifications on receipt, notify the carrier and TCI. Retain the shipping carton, packing boxes and the padding material for the carrier's inspection.

2.3 Installation Requirements

2.3.1 Environment

The Receiver operates satisfactorily within the temperature limits of +5° to + 40°C (0° to +50°C short term). The unit will operate satisfactorily after exposure to transport or storage temperatures between minus 40° to +70°C. The Receiver is not designed for direct exposure to outdoor environments.

2.3.2 AC Power

The Receiver can be operated at either 115 or 230 volts ±10%, 50/60 Hz AC. Voltage changeover is automatic.

2.4 Mounting

The Receiver is designed for installation into a standard 19-inch EIA rack. The unit requires 1U (or 1.75 inches) of vertical rack space. The maximum depth is 23-inches not including rear panel connectors.

Optional rack slide mount hardware is also available. An air space should be provided above and below the unit to allow free air circulation to cool the unit.

2.5 Cables and Connections

2.5.1 Connections to Other Equipment

The rear panel of the Receiver is shown in Figure 2-1.

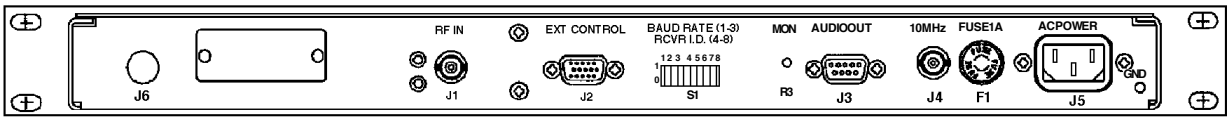


Figure 2-1 8174 Receiver Rear Panel

The external connections are as follows:

1. Between J5 and the AC power source (the supplied AC power cord).
2. Between the ground stud on the rear panel and the site grounding system (safety ground).
3. Between J3 and Audio Speaker and/or Audio Line.
4. Between J2 and the Host Computer.
5. Between J1 and the RF source.
6. Between J4 and the 10 MHz source (see paragraph 2.5.4).

2.5.2 Connectors Pinouts

The connectors pinouts for multipin control and audio cables are tabulated in Table 2-1 (J3) and Table 2-2 (J2).

2.5.3 Address and Baud Rate

Switch S1 on the rear panel of the Receiver chassis is an eight position DIP switch that sets both the remote control protocol “address” of the receiver channel, and speed of remote control data communications (baud rate) between the Receiver and the external computer.

The Receiver is typically shipped from the factory with standard factory settings of 19200 bits/second and ADDR 1, as shown in Figure 2-2. If other settings are needed, set switches S1-1 through S1-3 for the desired baud rate as shown in Table 2-3. Set switches S1-4 through S1-8 to set the channel address as shown in Table 2-4. Each receiver channel (i.e., each CPU/DSP module) can be set to respond to a specific address (defined in the 8174 Receiver remote interface protocol) from the external remote control computer. The address is determined by a 5-bit number programmed on switches S1-4 through S1-8. Valid addresses are 01 through 31 decimal (00001 through 11111 binary). Switch S1-8 is the least significant bit (LSB) and S1-4 is the most significant bit (MSB) of the 5-bit address number. If the

switches are all set to 0, the Receiver's internal CPU will convert setting 00000 to address 01. This is done because address 00 is reserved in the remote control protocol for commands issued to all receiver channels simultaneously. That is, if the external remote control computer issues a command to address 00, all receivers will respond to that command regardless of the address set by switches S1-4 through S1-8.

The serial remote control interface operates using standard ASCII printable characters. The serial RS-232 interface is either 7 or 8 data bits per character (the parity bit is ignored by the Receiver) plus single "start" and "stop" bits, yielding a total of 9 or 10 bits per character (see Section 7 of this manual for additional information).

Table 2-1 Model 8174 Receiver External Audio Interface Connection -J3

J3 = Male 9-pin D-submin connector (DE-9P).

Pin	Signal Name	Description
J3-1	HEAD	Speaker 250mW @ 8Ω (Monitor Audio)
J3-2	AGND	Analog signal ground return for speaker
J3-3	MAIN	Line Audio out, balanced pair wire A.
J3-4	MAIN	Line Audio out, balanced pair wire B.
J3-5		Not Used
J3-6	AUX	Line Audio out, balanced pair wire B.
J3-7	AUX	Line Audio out, balanced pair wire A.
J3-8		Not Used
J3-9		Not Used

The MAIN and AUX line audio outputs provide the same signal in all modes except ISB. In ISB mode, MAIN supplies the upper sideband signal and AUX supplies the lower sideband signal. The HEAD speaker monitor audio output can be selected from the MAIN or AUX audio signal through the remote control interface. The MAIN and AUX line audio volume levels, and the HEAD on/off control can be programmed independently through the remote control interface.

NOTE: The cable plug mating connector for J3 is a standard female 9-socket subminiature D (DE-9S). This connector is optionally available from TCI. Order TCI part number 1242-0180 for the connector and part number 1242-0268 for the connector backshell. Alternatively, order TCI part number 8074-1901-006 for a prefabricated 6-foot (2-meter) long audio cable assembly. This cable assembly contains a pre-wired cable plug that mates to J3 on one end, and uncommitted "pig-tail" wires on the other end.

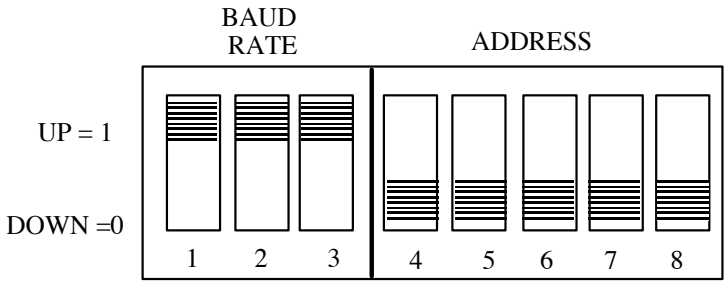
Table 2-2 Model 8174 Receiver Serial Control Interface Connection-J2

J2=Female high density 15-pin D-submin connector (HDD-15S)

Pin	Signal Name	Description
J2-1	SA	Serial bus, positive (EIA-485)
J2-2	Rx	Serial receive (RS-232)
J2-3	Tx	Serial transmit (RS-232)
J2-4	GND	Chassis
J2-5	GND/REF	Signal ground for RS-232/ Tx REF for RS-422/RS-423
J2-6	DSR	Pull up to +5V through 10K Ω
J2-7	Rx REF	Rx REF for RS-422/RS-423
J2-8	CTS	Pull up to +5V through 10K Ω
J2-9	SB	Serial bus, negative (EIA-485)
J2-10		Reserved
J2-11		Reserved
J2-12	DX Out	Data transmit (for CPU/DSP card with Pan display Option)
J2-13		Reserved
J2-14		Reserved
J2-15	DR In	Data receive (for CPU/DSP card with Pan display Option)
J2-Backshell	Drain	Cable shield

NOTE: The cable plug mating connector for J2 is a male 15-pin high density subminiature D (HDD-15P). This connector is optionally available from TCI. Order TCI part number 1242-0274 for the connector shell, and 15 each of part number 1242-0275 for the connector contacts. Also order part number 1242-0268 for the connector backshell. Alternatively, order TCI part number 8074-1902-006 for a prefabricated 6-foot (1.8-meter) long control cable assembly. This cable assembly contains a pre-wired cable plug that mates to J2 on one end, and uncommitted "pig-tail" wires on the other end.

Also available are completely pre-wired cable assemblies to connect receiver control connector J2 to the RS-232 COM ports of a computer. Cable part number 8074-1904-010 is 10 feet (3 meters) long and provides a mating connector for J2 on one end (HDD-15P) and a single 9-pin female RS-232 connector on the other end (DE-9S). If the Pan Display option is installed in the receiver, the two RS-232 ports are required on the external computer. Cable part number 8074-1905-010 is a pre-wired, 10-foot long cable assembly that connects the receiver (J2) to two RS-232 computer ports. This cable provides a mating connector for J2 on one end (HDD-15P) and two 9-pin female RS-232 connectors on the other end (two DE-9S).



SWITCH 1
Shown with Factory Default Settings for
19200 bps (Baud Rate setting 111) and
Address 01 (Address setting 00000)

Figure 2-2 Switch S1, Factory Default Settings

Table 2-3 Switch S1 Remote Control Baud Rate (BPS) Settings

S1-1	S1-2	S1-3	BPS
1	1	1	19200
1	1	0	4800
1	0	1	9600
1	0	0	600
0	1	1	2400
0	1	0	300
0	0	1	1200

Table 2-4 Switch S1 Address Settings

S1-4	S1-5	S1-6	S1-7	S1-8	Address
1	1	1	1	1	31
1	1	1	1	0	30
1	0	0	0	0	16
0	1	0	0	0	08
					etc.
0	0	1	0	1	05
0	0	1	0	0	04
0	0	0	1	1	03
0	0	0	1	0	02
0	0	0	0	1	01
0	0	0	0	0	See NOTE

NOTE: If S1-4 through S1-8 are all set to 0, the channel address will default to address 01

2.5.4 10 MHz Connector (J4)

Rear panel connector J4 can be used as either a 10 MHz external frequency reference input, or a 10 MHz reference signal output. Selection of 'input' or 'output' is determined by changing a connectorized jumper cable inside the Receiver. When shipped from the factory, J4 is normally configured for 'input'. That is, the standard configuration of the Receiver uses J4 to provide a means to apply an external 10 MHz frequency reference (such as a "station standard") to lock the frequency synthesizer in the Receiver to an external frequency standard (see paragraph 3.4 of this manual). If no external standard is connected to J4, the internal synthesizer will lock to its own internal 10 MHz reference oscillator. If J4 is configured as an output, a buffered 10 MHz signal derived from the Receiver's synthesizer internal reference oscillator is available. This 10 MHz output at J4 has an amplitude of approximately +10 dBm (into 50 ohm).

2.5.5 Interconnect Information

Figures 2-3 through 2-6 illustrate connections between the 8074/8174 receiver and a computer used to control them.

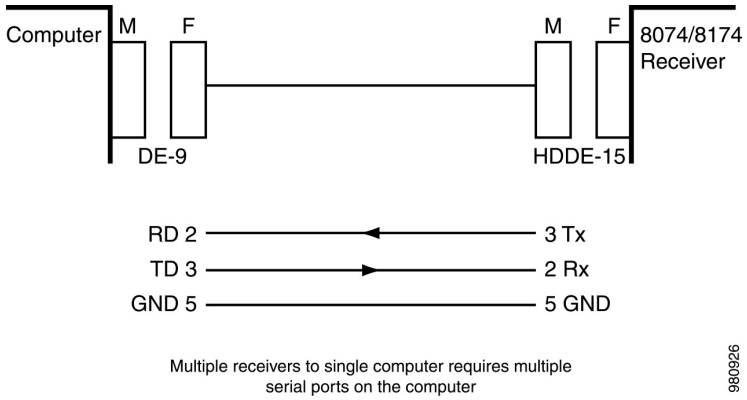


Figure 2-3 Computer RS-232 with DE-9 Connector to Single Receiver

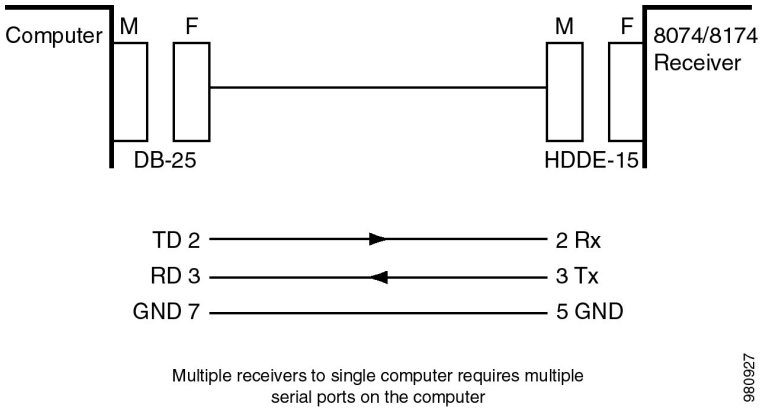


Figure 2-4 Computer RS-232 with DB-25 Connector to Single Receiver

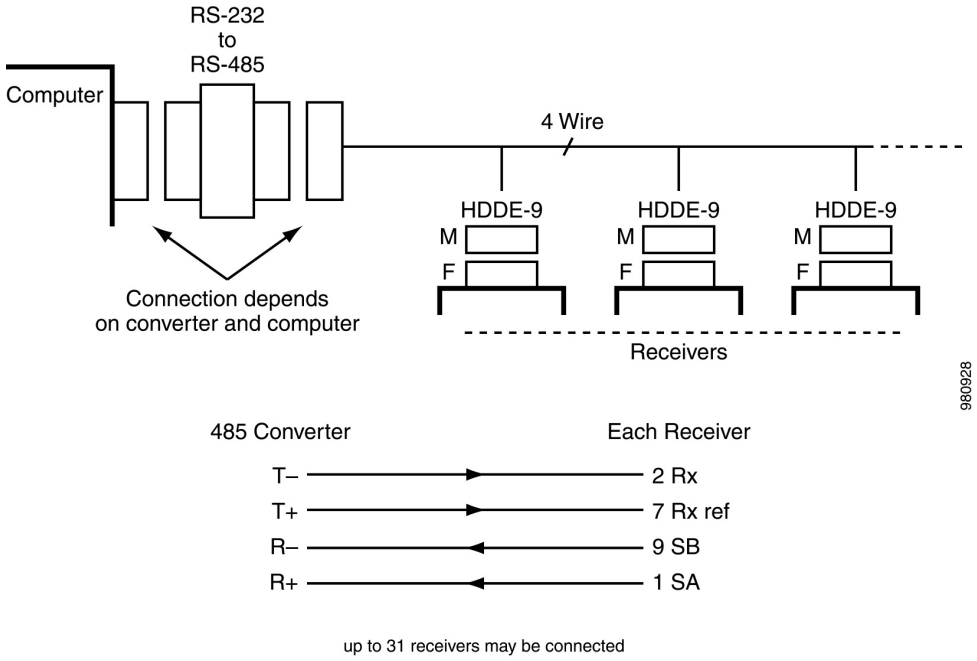


Figure 2-5 Computer RS-232 with 4-Wire RS-485 Converter to Multiple Receivers

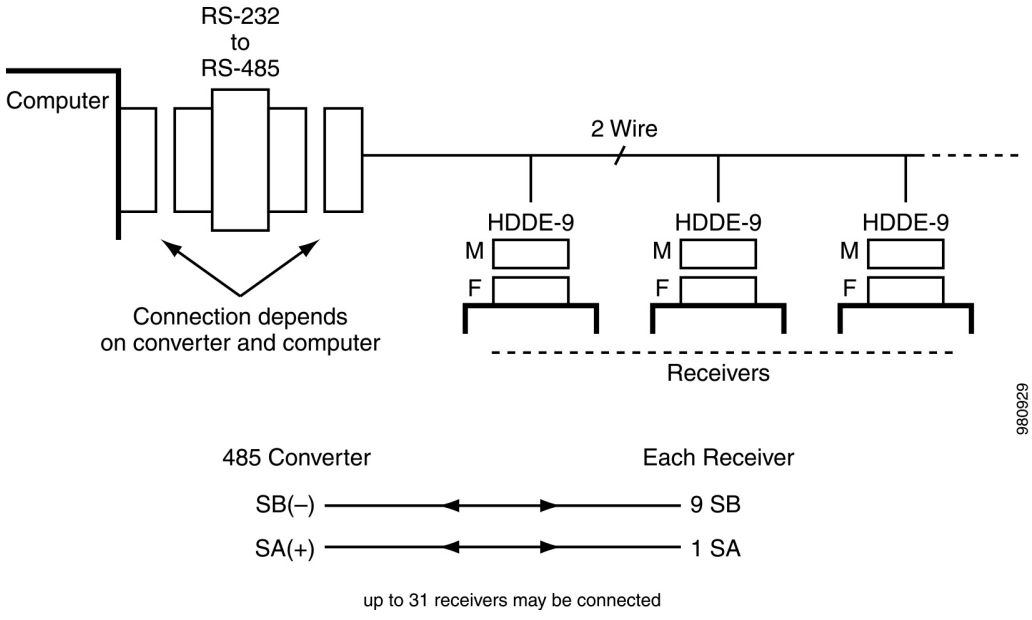


Figure 2-6 Computer RS-232 with 2-Wire RS-485 Converter to Multiple Receivers

2.6 Post Installation Checkout

The electrical performance of the Receiver should be verified after installation. The tests described in Section 5 of this manual should be performed as the post-installation checkout prior to operation. In addition, overall performance should be periodically verified by these tests.

2.7 Storage and Reshipment

2.7.1 Storage

The maximum recommended storage environment should not exceed –40° to +70°C temperature and 95% humidity. For long term storage, repackaging of the equipment and sealing of the cables into moisture proof bags is recommended.

2.7.2 Reshipment

The Receiver should be packaged carefully in a moisture resistant container for reshipment. The unit should be surrounded by high density foam and securely packed in a wooden crate for reshipment.

2.8 Electromagnetic Compatibility

The Model 8174 Receiver is designed to operate in typical HF radio environments in mobile or fixed installations in accordance with the guidelines of MIL-STD-5400 and MIL-STD-461C (Part 2, Class A1) for Electromagnetic Compatibility (EMC) in terms of electromagnetic interference and susceptibility to/from other electronic equipment. However, the Receiver does not necessarily meet all spec limits defined by MIL-STD-461C at all frequencies. Refer to the Receiver specifications in Section 1 of this manual for specified performance.

3. OPERATION

3.1 Introduction

This section provides the basic information required to use the Receiver. It is a brief description of the controls and indicators of the unit itself.

3.2 Receiver Front Panel Controls and Indicators

3.2.1 Power Switch

The front panel has a POWER ON/OFF rocker type switch. Turn this switch ON to use the Receiver.

3.2.2 Status Indicators

There are three status LEDs on the Receiver's front panel. The significance of each LED is (from left to right):

a. DC POWER. Green LED indicates DC power to internal modules is ON.

b. RUN. Green LED indicates CPU/DSP is running.

c. FAULT. Red LED indicates synthesizer lock error.

During normal operation, with the POWER switch ON, the front panel DC POWER and RUN LEDs will illuminate green and FAULT LED will not be illuminated. If either red LED turns on, or if either green LEDs go out, there is a problem with the Receiver that may affect its operation or performance.

✍ **NOTE:** *The FAULT LED may flash momentarily when scanning (Channel Scan) or when making frequency changes over a MHz. When making large frequency changes, the synthesizer may momentarily break lock which may cause the red FAULT LED to flash momentarily. This is normal as long as the flash is brief, i.e., less than 0.1 seconds.*

3.3 Receiver Operation

3.3.1 General

All normal operating functions of the Receiver are externally controlled by a remote PC computer. They include: tuned frequency, demodulation mode, demodulation bandwidth, BFO, gain control, squelch, audio output volume, scan modes, scan parameters, built-in test, and receiver status monitoring. These functions are user-controllable with the standard 8074 VCP software package or other custom (user-generated) remote control software application.

3.3.2 AGC Response

The Receiver has selectable AGC (and ALC) response characteristics. There are four standard AGC modes: Fast, Medium, Slow, and Slow Data. Suggested uses are:

'Fast'	for typical SSB HF high speed data modem.
'Medium'	for typical SSB HF low/medium speed data modems.
'Medium'	for AM modulation.
'Slow'	for SSB voice or keyed CW.
'Slow Data'	for burst-type data with narrow bursts that occur infrequently.

3.4 External 10 MHz Reference

The internal synthesizer can be locked to an external 10 MHz frequency reference ("Station Standard"). An accurate station standard frequency reference will improve the frequency accuracy of the Receiver.

The Receiver accepts a sine-wave (or square wave) external 10 MHz reference 0.5–1.5 Vrms range. The input impedance of the external 10 MHz input is 50 ohm. When the proper external 10 MHz reference is connected to the Receiver rear panel BNC jack J4, the synthesizer will automatically switch off the internal 10 MHz reference and use the external reference instead.

The external 10 MHz reference must be free of spurious (e.g., power line hum) and noise. In general phase modulated hum sidebands should be –80 dBc and phase noise should be less than –120 dBc/Hz at 1 kHz offset.

4. THEORY OF OPERATION

4.1 Introduction

This section describes the function and operation of internal boards of the Model 8174 HF Monitor Receiver. Figure 4-1 is a simplified block diagram of the Receiver.

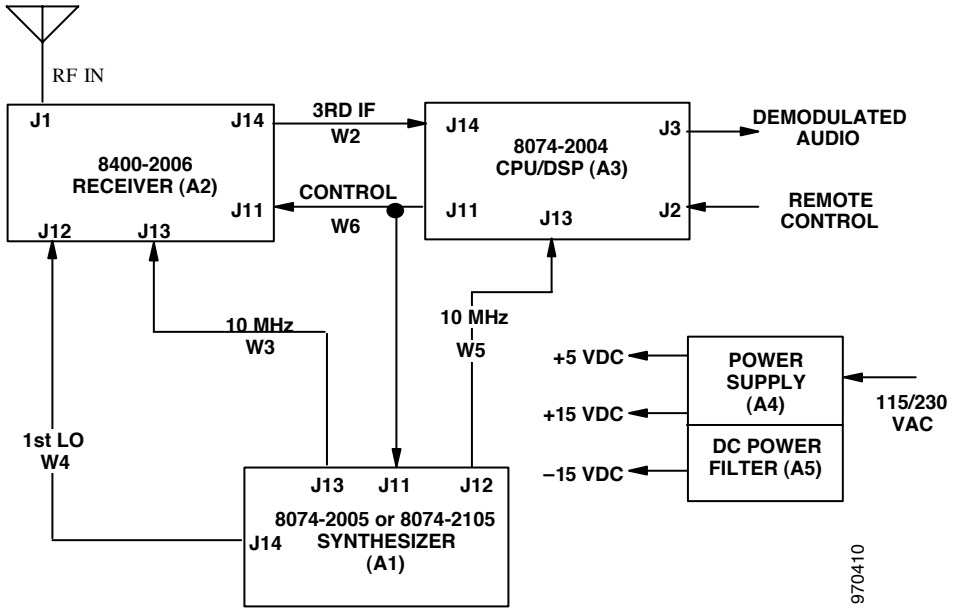


Figure 4-1 Simplified Block Diagram of the Receiver

4.2 Receiver Board (8400-2006)

The 8400-2006 is the RF/IF section of the Receiver. The Block Diagram of this board (Drawing No. 8400-4206) is provided in the foldout section of this manual.

The 8400-2006 accepts an RF signal (at J1) in the 1.5 to 30 MHz range (optionally .01–30 MHz), and converts it to 5 kHz at the 3rd IF output with a nominal output level of 2 volts peak-to-peak. The signal first passes through a VHF filter to reject any image frequencies or possible LO emissions. Next is a bank of six sub-octave preselection filters. The signal is then converted to 40.455 MHz in the first mixer. After passing through an amplifier, switchable attenuator, and a 15 kHz BW filter, the signal is mixed down to 455 kHz. The signal is further amplified and filtered to its final bandwidth, optionally 3, 6, or 12 kHz. The signal now makes its way through 80 dB of amplification and 84 dB of switchable attenuation, in 6 dB increments. Finally, the signal is mixed and amplified to the 3rd IF output. The receiver also produces a linear detector output whose nominal level is 1 volt. The receiver functions are controlled by a series of four control bytes. These bytes specify the address of the receiver module to be controlled, set the receiver gain to a resolution of 6 dB, select the active preselector, and enable/disable the calibrator (BITE).

4.3 CPU/DSP Board (8074-2004)

The CPU portion of the 8074-2004 controls the basic operation of the Receiver. It communicates through a serial port with the outside world. At the same time, it controls the actions of the DSP(s) in the DSP portion of this board, receiver (RF/IF) and synthesizer boards. The primary DSP is used to demodulate and filter the 3rd IF signal. The Line and Monitor Audio outputs of the Receiver are generated by the primary DSP and fed to a dual A/D converter for reconstruction back to analog signals. The Receiver uses 14-bit A/D converters and 32-bit DSPs to provide superior demodulation accuracy and linearity. The optional second DSP can be programmed as required for optional features of the Receiver. For example, one of second DSP functions is the Pan display data generator. The second DSP input data can be obtained directly from the 3rd IF, or from the output of the primary DSP. The second DSP output is through a digital serial interface only.

4.4 Synthesizer Board (8074-2005 or 8074-2105)

✍ **NOTES:** *1. Both Synthesizer boards have the same features and functions, but different layout.*
2. The documentation on both synthesizers is provided in the foldout section of this manual.

Refer to block diagram, Figure 4-2. The Synthesizer circuit is a digitally programmed, "Fractional N", phase-locked-loop synthesizer capable of generating any frequency between 40 and 70 MHz to 1 Hz resolution. It consists of a 40–70 MHz VCO, a programmable divider (÷N), a phase detector and loop amplifier, and control logic (phase register and timing generator). Figure 4-2 is a simplified block diagram of the synthesizer.

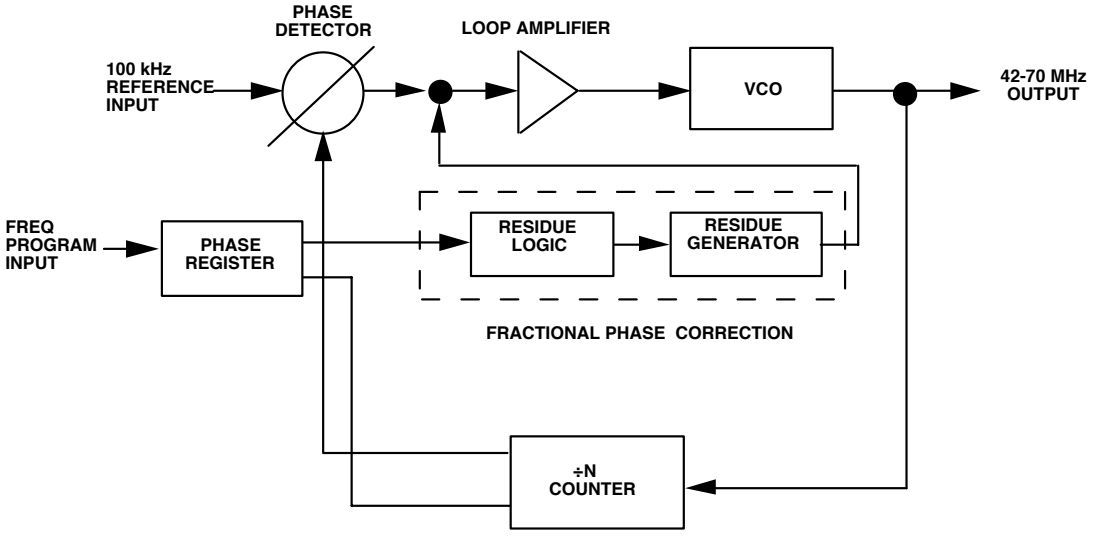


Figure 4-2 Simplified Block Diagram of Synthesizer

The output frequency of the VCO (and the synthesizer) is determined by electrically tuning the VCO with a control voltage from the loop amplifier. The loop amplifier produces this control voltage by integrating (smoothing) the phase error signals generated by the phase detector. If there is no phase error, the output of the phase detector is zero and the loop amplifier will hold the VCO at its existing frequency. If there is a phase error the detector will drive the loop amplifier to change the VCO frequency until the error is corrected.

The synthesizer uses the phase detector to compare the output of the ÷N counter with a fixed 100 kHz reference signal. If the phase or frequency of these two signals do not match, the phase detector will drive the loop amplifier to adjust the VCO frequency until the ÷N output exactly matches the 100 kHz reference, thereby achieving phase lock.

The VCO output frequency is always N times 100 kHz. There are N cycles of the VCO output for every one cycle of the 100 kHz reference. If N is an integer number, the VCO frequency will be an exact multiple of 100 kHz. However, if N is a number consisting of both integer and fractional components, intermediate frequencies between 100 kHz points may be synthesized. For example, to produce a 43.5 MHz output the ÷N counter must divide by 435. If an output of 43.501 MHz is desired, the required divide ratio is 435.01. The ÷N counter, however, is a 3 decade counter only capable of dividing by integer numbers between 400 and 700. To divide by 435.01 the phase register circuitry programs the ÷N to divide by 435 for 99% of the time and divide by 436 for the remaining 1%. The resulting average divide number is:

$$\frac{(99 \times 435) + (1 \times 436)}{100} = 435.01$$

Because the synthesizer basic timing reference is 100 kHz, the ÷N counter completes a count sequence (frame) every 10 μs. In the above example the ÷N will count 435 VCO cycles (zero crossings) for ninety-nine 10 μs frames and 436 cycles for one frame. The phase detector and loop amplifier will then try to drive the VCO to operate at 43.50 MHz for 990 μs and at 43.60 MHz for 10 μs. The resulting VCO output is a phase modulated signal with an average center frequency of 43.501 MHz with 1 kHz sidebands. The 1 kHz sidebands result from the "jumps" in VCO frequency occurring every one millisecond (990 μs + 10 μs = 1 ms).

The amplitude of the sidebands can be reduced by smoothing the "jumps" in frequency such that the VCO remains steady at the average frequency and does not follow the loop back and forth between the two programmed frequencies. However, to reduce the sidebands to an acceptable level (-50 dBc) requires smoothing (slowing) the loop response to such an extent that the synthesizer would no longer be suitable for sweeps used in Chirpsounder applications.

These sidebands may be canceled however, by using a fast loop and a fractional phase correction circuit operating in conjunction with the ÷N.

Note that the average frequency of the VCO is correct. Therefore the average value (or dc component) of the VCO control voltage from the loop amplifier is correct. The undesired 1 kHz sidebands are produced by the sudden phase errors generated when the ÷N counter "jumps" between the two programmed integer divide numbers. This produces a small momentary change in the VCO control voltage which modulates the VCO frequency resulting in sidebands. The fractional phase correction circuit cancels the VCO modulation by injecting a compensating phase error correction signal into the loop amplifier to counteract the effect of the phase error jump when the ÷N skips from one divide ratio to

another. The phase register keeps track of when to "skip" the ÷N from one divide ratio to the next and simultaneously programs the residue logic of the fractional phase correction circuits. The residue logic determines the phase correction that must be made in each 10 μs frame to cancel the fractional phase error. The residue logic drives the residue generator, which produces the fractional phase error correction signal that is injected into the loop amplifier. By careful alignment of the residue generator, the synthesizer sidebands can be suppressed better than 50 dB below the fundamental frequency output level.

The ÷N counter consists of a VCO prescaler which typically divides the VCO output frequency by 2. The prescaler also contains a pulse skipper circuit that makes the ÷2 circuit skip one extra VCO clock pulse each time a skip command is given. This effectively turns the prescaler into a ÷3 circuit during a skip command. The output of the VCO prescaler drives the VCO divider. The combination of the VCO divider and the VCO prescaler is capable of dividing by any integer number between 400 and 700. For example, to divide by 437, the VCO divider counts 430 times and the VCO prescaler skips 7 extra VCO clocks during the count sequence, yielding a total count of 437.

The phase register accepts 4-bit binary-coded-decimal (BCD) frequency program data from the frequency programmer. All 8 decades of BCD data are transferred serially on a decade by decade basis every 10 μs. All timing signals needed by the synthesizer are produced by the timing generator circuit. The timing generator controls the transfer of frequency data to the phase register and ÷N counter, and controls the timing of the fractional phase correction (residue) circuitry.

Control of the synthesizer is accomplished by the use of four data lines, two controls lines and a strobe line. The control and data information is presented and then read by the synthesizer when the strobe line is pulsed. The lock detector also outputs a status bit which can be read by the CPU.

4.5 Power Supply and DC Power Filter

The Receiver uses a high reliability switching power supply module that outputs +5 VDC/1.5A, +15 VDC/1.2A and –15 VDC/0.3A to the DC Power Filter (8174-2001-01). The filtered outputs are routed to the synthesizer, receiver and CPU/DSP boards. Each of these boards provide more line regulation and voltage breakdown to meet internal circuit needs.

5. MAINTENANCE

5.1 Model 8174 Receiver Functional Test

Perform the following functional test on the Receiver following installation and cable interconnection as described in Section 2, and after installation of VCP software as described in Manual 0040-8074-15003, Section 3.

a. Verify that the RF input into the unit is connected to an antenna or other RF source.

b. Turn the computer and Receiver on and enter the 8074 VCP program.

c. When starting the program, the software searches for the Receiver over the serial control port. If it is not found, an error message is displayed on the screen. When this message is displayed, it is most likely that the Comm port is not set up correctly. Enter the VCP and set up the Comm port as described in the manual 0040-8074-15003, section 3. After resetting the Comm port, exit the VCP application and then restart it.

d. After successfully entering the VCP program without error messages, exercise some of the basic Receiver controls (i.e., use mouse to enter drop-lists and menus, etc.) to verify that the computer interface is functional.

e. Perform BITE test to verify Receiver is functioning correctly.

f. Change the frequency to a known signal of opportunity or a known RF source.

g. Use the Receiver controls to properly set Receiver parameters and to listen to detected signal, to verify that the parameters change as expected.

5.2 Repair by Replacement of Boards

All boards of the Receiver are mounted to the bottom of the chassis and accessed by removing the top cover of the Receiver (see Figure 5-1). All of them can be replaced with spared boards.

After removing the top cover, unplug the connectors and remove any board in question by loosening the hold-down screws, and then pulling the board directly up. Replace with a known working board, and replace the hold-down screws.

5.3 Line Audio Outputs

The nominal level of the line audio outputs can be set by adjusting variable resistors (potentiometers) R1 and R2 on the CPU/DSP board inside the Receiver. (Remove the unit top cover for access to the CPU/DSP board as shown in Figure 5-1.) R1 sets the AUX line audio level and R2 sets the MAIN line audio level. The nominal levels are typically set to 0 dBm (into 600 ohms) at the factory, but may be independently adjusted over a range of approximately +3 to –13 dBm.

5.4 10 MHz Reference

Rear panel connector J4 is normally configured for a 10 MHz external frequency reference input. To change J4 to a 10 MHz output:

a. Remove the top cover of the unit.

b. Follow the coax cable from rear panel J4 to a pair of SMB jacks (J7 and J8) on the metal shield separating the synthesizer board from the power supply compartment. This coax is normally connection to J7 which is the 10 MHz INPUT to the synthesizer.

c. To convert J4 to an OUTPUT, disconnect the coax cable from J4 that normally connects to J7 and connect it to J8 instead. To disconnect, grasp the mating coax plug on the end of the cable and pull straight back from the shield towards the rear panel until the connectors separate. Then reconnect to J8 by pushing the plug straight on to J8 until it clicks into place. J8 is the synthesizer 10 MHz output and is located right next to J7. Note that connectors J7 and J8 are not labeled. See Figure 5-1 to identify the locations of J7 and J8.

d. Replace the top cover of the unit.

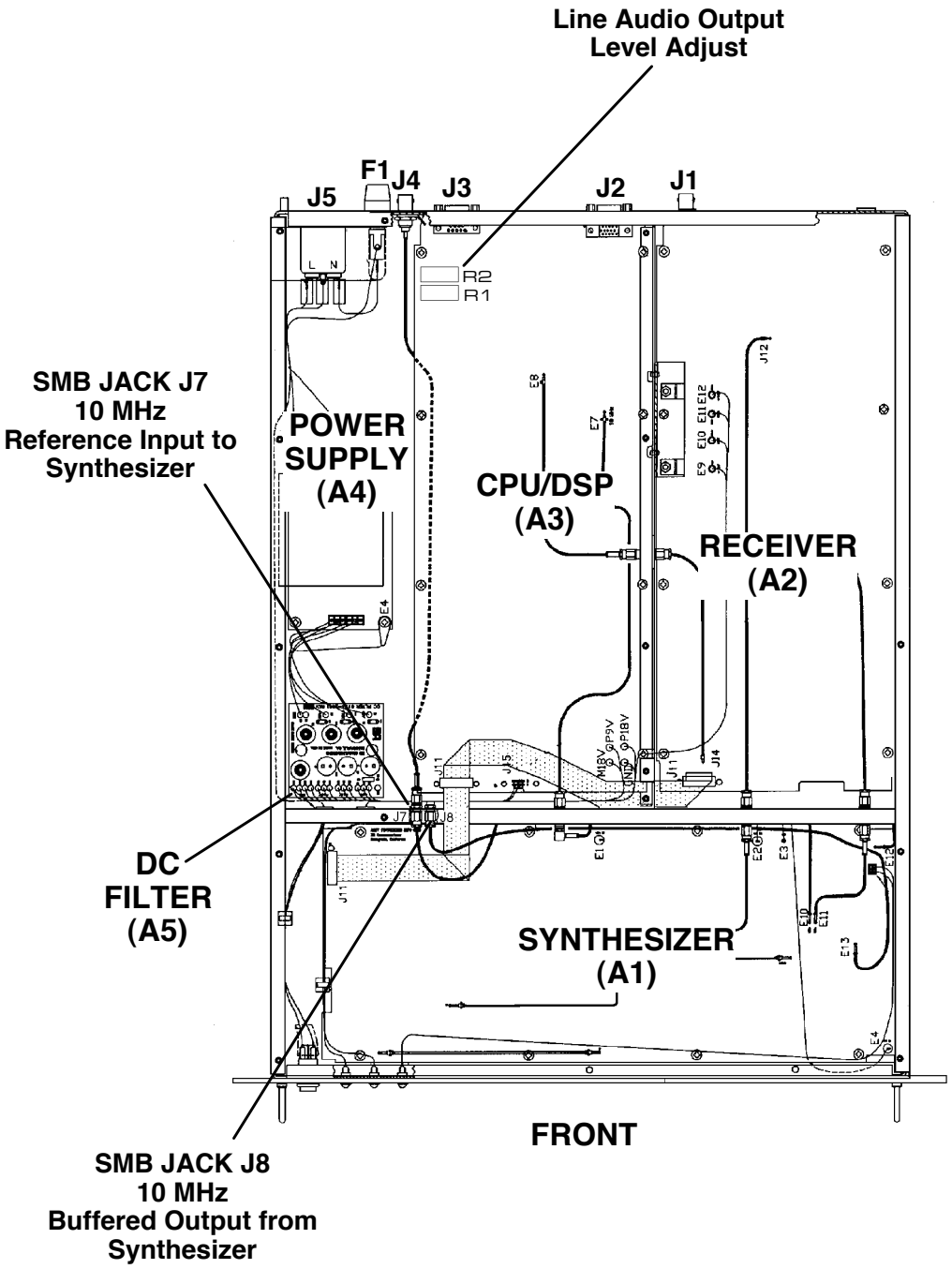


Figure 5-1 Top View of Model 8174 Receiver with Cover Removed

6. OPTIONS, VERSIONS, AND PRODUCT IMPROVEMENT

6.1 Introduction

The Model 8174 Receiver is available with different hardware options, hardware configurations, and firmware (software) versions. These options and versions are encoded in the part number (on rear panel) as explained below. This section describes the options and versions applicable to the unit bearing the appropriate part number. Product improvement information related to the application of these options and/or versions is also provided in this section.

6.2 Configurations

The Receiver may be ordered in a number of different configurations, depending upon the needs of the user. The following information explains the top assembly part numbering convention which is marked on the 8174 Receiver ID tag located on the rear panel. The ID plate format is shown in Figure 6-1.

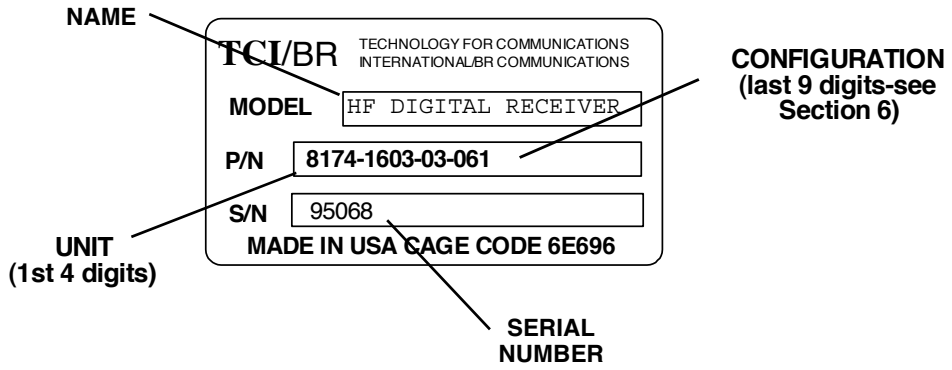


Figure 6-1 Identification Plate Format

The complete 8174 Receiver is identified by a 13-digit part number of the following formats:

8174-15AA-BB-CCD or 8174-16AA-BB-CCD, where:

AA indicates the type of synthesizer (8074-2105) used in the unit. There are currently three versions available that define the stability and accuracy of the internal 10 MHz frequency standard within the synthesizer; AA=01 for 100 ppm stability, AA=02 for 10 ppm, and AA=03 for 1 ppm.

BB indicates the firmware of the CPU/DSP (8074-2004). There are two available; standard (BB=03), and with pan display option (BB=04).

CC indicates the version of receiver (8400-2006). Standard for the 8174 Receiver for general purpose monitoring applications is CC=03, applications with extended frequency range at the lower end is CC=06.

D indicates the number of receiver channels. D=1 for a single receiver channel.

For example, a one-channel Receiver fitted with a 1 ppm synthesizer and standard CPU/DSP and receiver modules would have a top assembly part number of 8174-1503-03-031.

6.3 Revisions

TCI maintains an on-going product improvement program. Hardware and firmware (software) are reviewed by the factory for performance, reliability and maintainability.

When improvements or modifications to the equipment are made, the equipment and supporting documentation are updated to the next revision level if the existing assembly is compatible with older equipment. Higher (more recent) revision assemblies are compatible and interchangeable in form, fit, and function with lower (older) revision levels. Revisions are controlled and documented by a revision (REV) letter. There are separate revisions for hardware and firmware. Hardware revisions letters are stamped on all assemblies. Assemblies which have been changed such that they are not compatible or interchangeable with older equipment are identified by changing the part number.

When contacting the factory about any maintenance questions or when ordering spare parts, it is best to supply the complete TCI part number, version number, revision letters and unit serial number from the unit ID plate, and/or the specific module in question, with your inquiry or order.

7. REMOTE INTERFACE PROTOCOL

7.1 Introduction

This communications protocol is to provide an interface between a host (computer) and up to 31 HF Receivers. The Receivers require some direction as to what frequency to tune to and what receive method to use. The host provides them with this direction. The Receivers also provide status and other information for the host. The protocol is designed such that the host can be anything from a dumb terminal to a computer as long as it "speaks" ASCII character set with RS-232 or EIA-485, and that the Receivers are either directly connected to the host (RS-232), or bussed together (EIA-485).

The assumption is made that the host is in control and the Receivers never transmit unless explicitly directed to respond to a host query. Each Receiver will have been programmed with its unique identification code so that it will respond only to commands that contain that identification code. In order to make wholesale changes, a broadcast code is provided. This broadcast code allows the host to send commands that need to go to all (or many) Receivers at the same time. Commands that require the Receiver to return specific information are not allowed to use the broadcast feature, since in broadcast mode there will be no responses allowed. If responses were allowed in broadcast mode, there would be no simple method for preventing responses from multiple Receivers to overwrite each other on the serial bus.

There is no provision for either hardware nor software handshaking in the DTR/CTS and XON/XOFF sense. This protocol assumes that all Receivers can keep up with the data at the rate selected. Data rates can vary from 300 to 19,200 baud, but bussed systems are required to run all Receivers at the same data rate.

There is software handshaking in the sense that all non-broadcast commands need to be acknowledged within a set period of time, 0.5 to 1 second, so that the host device can feel confident that the requested operation has been performed by the specified Receiver. The type of acknowledge is dependent on the command sent by the host. A command may require data to be returned. This data is considered the acknowledge. For each command there is a given acknowledge described. A not-acknowledge will be sent only when a correctly received command string is not executed successfully or contains an unimplemented (illegal) command code. No response is made if the command prematurely terminated (a new start character is detected before a stop character is found). The host will then time out. In the case of a checksum error the addressed Receiver will respond with a Not-Acknowledged response.

7.2 Command Encoding

All commands are encoded in a fixed format. All characters are 7-bit printable ASCII characters so that testing and operation can be handled by any kind of dumb terminal. (The most significant bit is ignored so that the terminal can send data with or without parity in that bit.) Each command is enclosed by a start and end character, characters that may not occur anywhere else in the command or data stream. Any time binary data is to be sent, it will be dissected to fit into 4-bit nibbles with the least significant nibble sent first.

Table 7-1 Command Encoding

Code(s) Used	Name	Description
Value 123 {	Start Byte	Fixed character denoting start of command. May not appear anywhere else in data stream.
Values 64..95 / @ A..Z [\ ] ^ _	Rx Id	Receiver identification code. This byte identifies which Receiver is addressed, and all Receivers that do not have this address can stop listening until the next start byte. The @ is reserved for broadcast mode where the command applies to multiple Receivers at once.
Values 64..95 / @ A..Z [\ ] ^ _	[Rx Id…] Optional	Optional broadcast mode Receiver identification code(s). This code indicates the Receivers to be included in the broadcast command. There can be up to 31 instances of this code, one for each Receiver. The @ is reserved for broadcast mode where the command applies to all Receivers at once.
Value 33 !	Host Id	When a Receiver replies, this is the code used to indicate that it is addressing the Host. This must be followed by the Receiver's Id.
Values 65..95/ A..Z [\ ] ^ _	Rx Id	Receiver identification code. This byte identifies which Receiver is addressing the Host.
Values 96..122 ` a..z	Command	The command to be performed. This code also determines if there will be length and or data bytes following.
See below at [Data]	[Command modifier(s)]	Optional character code(s) which add value to the command. The content and number of characters is command dependent.
Values 32..122 SPACE..z	[Length]	The presence of this optional byte is determined by the command above. It is only sent when required for variable length data commands. This byte indicates the number of bytes of data to follow. The count entered is 31 more than the number of bytes to be transferred (i.e., 32 (0x20) means 1 byte follows, 95 (0x5f) means 64 bytes follow). The maximum number of data bytes per variable length command is 91. The legal codes range from 0x20 through 0x7a (ASCII characters SPACE through z).

Table 7-1 Command Encoding (continued)

Code(s) Used	Name	Description
For HEX data: Values 48..63, or 48..57&97..102, or 48..57&65..70 0..9 : ; < = > ? or 0..9 a..f or 0..9 A..F For text data: Values 32..122 SPACE..z For BCD data: Values 48..57 0..9	[Data]	Optional data related to the command. This can be a fixed or variable number of bytes depending on the command above. There are three (3) sets of characters to convey the four bits of HEX information—they may be mixed. If the data to be transferred is binary, bytes, words, or anything larger than four (4) bits, it is first converted into 4-bit nibbles and sent least significant nibble first. The command responsible will re-assemble them at the receiver side. When data transferred is text, any printable character will do, except for the { and } characters. Certain commands may have a fixed number of data bytes associated with it and therefore not need a length byte. The maximum data bytes per command remains 64.
Values 48..112 0..o	CS Code 1	Check Sum code contains the sum of all bytes of the command, excluding the start, stop, and Check Sum bytes, and ignoring the 8th (ms) bit of each byte, modulo 4096. In this byte, the lower 6 bits of the Check Sum plus offset 48 is sent. The legal codes range from 0x30 through 0x6f (ASCII characters 0 through o). For ease of testability, but reduced confidence, the SPACE character can be inserted here, indicating no Check Sum is to be performed. The SPACE character must then also be present in Check Sum Code 2.
Values 48..112 0..o	CS Code 2	This byte contains the upper 6 bits of the Check Sum modulo 4096, offset by +48. The legal codes range from 0x30 through 0x6f (ASCII characters 0 through o). For ease of testability, but reduced confidence, the SPACE character can be inserted here, indicating no Check Sum is to be performed. The SPACE character must then also be present in Check Sum Code 1.
Value 125 }	End Byte	Fixed character denoting end of command. May not appear anywhere else in data stream.

7.3 Commands

7.3.1 Incoming (Into Receivers)

7.3.1.1 Program Receiver

{ *Rx Id* [*Rx Id…*] **p** *Data-x CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
p = Command character;
Data-x = Nine characters of ASCII data that contain all the information necessary to set the radio to the desired state (not including frequency)—See Table 7-1 for [data] and below for data break-down;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Set the Receiver to the state specified in the data block. The data block contains enough information to set the radio to any of its possible states. It is formatted as follows (any portion of this data that is not required for the specified demodulation is ignored):

Table 7-2 Data Block Format

Char.	Description	Command
0	Demodulation type	Single ASCII character specifying demodulation
1	Low pass filter code	Single ASCII character specifying low pass filter
2	High pass filter code	Single ASCII character specifying high pass filter
3	ALC mode	Single ASCII character specifying ALC mode
4	AGC mode	Single ASCII character specifying AGC mode
5..6	Manual gain value	Two ASCII hex digits in the range of 0x00..0x7b (-dBm). (5 = Ms, 6 = Ls) 00 = Max. attenuation
7..8	Squelch value/code	Two ASCII hex digits in the range of 0x00..0x7f (-dBm). (7 = Ms, 8 = Ls) 00 = Max. squelch, 7f=No squelch

The purpose of this command is to set the Receiver to a known state in the least amount of time. See Tables 7-3 and 7-4 for Filter, AGC and ALC settings.

Returns: Acknowledge | Not acknowledge

7.3.1.2 Set Frequency

{*Rx Id* [*Rx Id…*] **f** *Data-8 CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
f = Command character;
Data-8 = Eight (8) characters of BCD-type data—See Table 7-1 for [data];
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Set the frequency of the Receiver to the one specified in the data block. The data block is formatted as follows: All characters used are the codes for the ASCII characters 0..9. The first digit entered stands for the 10's of MHz. The next digit is 1's of MHz. And so down to the eighth digit which is the 1's of Hz, the lowest resolution the Receiver can handle. All eight digits must be entered, including leading zeros when using frequencies less than 10 MHz. No decimal points or any other characters are acceptable.

✍ **NOTE:** *Setting the frequency will clear the AGC and ALC hang time counters for immediate AGC and ALC action.*

Returns: Acknowledge | Not acknowledge

7.3.1.3 Step Frequency

{ *Rx Id* [*Rx Id…*] **s** *Data-2 CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
s = Command character;
Data-2 = Two (2) characters, the first character is one of 'a'..'h' or 'A'..'H'; the second character is one of '0'..'9';
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Step the frequency of the Receiver by the amount specified in the data block. The data block is formatted as follows: The first character indicates the direction of the step and which decade is stepped. Each decade is specified by a letter, where a or A is the 10's of MHz, and up to h or H which is the 1's of Hz. For stepping in the higher direction, the letters are upper case, while stepping down in frequency is indicated by lower case letters. The second character is one of the codes for the ASCII characters 0..9, indicating the amount stepped. The user will not be allowed to step past the upper nor lower frequency limits of the radio. It will stop at the limits.

Returns: Acknowledge | Not acknowledge

7.3.1.4 Set AGC Mode

{ *Rx Id* [*Rx Id…*] **a** *Data-1 CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
a = Command character;
Data-1 = One (1) character that indicates which AGC mode is desired, and ranges from '1'..'9' (0x31..0x39);
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Set the AGC to the mode desired. If mode 1 (one) is chosen, the radio is set to manual gain mode, and the gain setting is left at the same point AGC algorithm had last moved it to. Gain (attenuation) can now be programmed by the Set Manual Gain Level command, described later. Other settings relate to the coefficients used in the AGC algorithm, shown in Table 7-3.

Returns: Acknowledge | Not acknowledge

7.3.1.5 Set ALC Mode

{ *Rx Id* [*Rx Id…*] m *Data-1 CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
m = Command character;
Data-1 = One (1) character that indicates which ALC mode is desired, and ranges from '1'..'9' (0x31..0x39);
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Set the ALC to the mode desired. If mode 1 (one) is chosen the radio will not perform any ALC function. ALC level will remain where last set by the ALC algorithm, and is used in tandem with the AGC mode 1 setting for manual gain control. Other modes relate to the coefficients used in the ALC algorithm, shown in Table 7-3.

Returns: Acknowledge | Not acknowledge

7.3.1.6 Set Squelch Level

{ *Rx Id* [*Rx Id…*] **t** *Data-3 CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
t = Command character;
Data-3 = Three (3) characters that indicate the squelch level desired, in minus dBm units and ranges from '000'..'127';
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Set the squelch level to the value entered. The number entered is the absolute receiver gain setting in minus dBm. In case of ISB, this squelch setting applies to both USB and LSB. The squelch threshold is determined by the AGC (manual gain) setting in the micro-controller together with the ALC level in the DSP. A value of 127 turns squelch off.

Returns: Acknowledge | Not acknowledge

7.3.1.7 Set BFO

{ *Rx Id* [*Rx Id…*] **i** *Data-5 CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
i = Command character;
Data-5 = (+ or -) followed by four (4) characters of BCD-type data, shown in Table 7-1;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Set the BFO of the Receiver (for use in CW mode only) to the one specified in the data block. The data block is formatted as follows. The first character is a sign (+, -, or space which is the same as +). The remaining four characters are the codes for the ASCII characters 0..9. The first digit entered stands for the 1's of kHz. The next digit is 100's of Hz. And so down to the fourth digit which is the 1's of Hz, the lowest resolution the Receiver can handle. All four digits must be entered, including leading zeros when using frequencies less than 1 kHz. No decimal points or any other characters are acceptable (other than the leading sign bit).

Returns: Acknowledge | Not acknowledge w/ error code

7.3.1.8 Set Volume

{ *Rx Id* [*Rx Id…*] **n** *Chan Data-3 CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
n = Command character;
Chan = 1 for main channel, 2 for auxiliary channel, 3 for both channels simultaneously;
Data-3 = Three (3) characters that indicate the volume level desired, in percent relative to nominal, and ranges from '000'..'125';
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Set the volume level to the value entered for the channel(s) specified. The number entered is the percentage output relative to nominal. It affects both the monitor and line outputs, and 100 is the nominally designed level. Limits are 0 to 125%.

Returns: Acknowledge | Not acknowledge

7.3.1.9 Set Frequency List

{ *Rx Id* [*Rx Id…*] **I** *function data-I CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
I = Command character;
function = A single character indicating what frequency list command is desired;
data-I = Character data associated with the frequency list command;
CS1 = Ls 6 bits of CS code—See Table 7-1 or CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

The Frequency List command directs the Receiver to perform a frequency list function. The actual function to perform is indicated in *function* as shown below. These commands are a typical set of list housekeeping commands. Any special functions using the frequency list will be handled elsewhere.

Function = a Abort (stop/pause) the currently active scan. If no scan is active, the command is ignored. If no list changes are made, the next channel will be the channel logically following the one that was aborted;

= b Bulk status setting,

data_I contains 20 characters in the range of '@'..'_' (0x40..0x5f) where the five (5) Ls bits reflect the status for five consecutive channels. Channel 00 is the Ls bit of the first character. Channel 01 is the next higher Ls bit in the first character. And so on to channel 99 being the Ms bit of the five bits in the twentieth character. For each bit that is a one (set), the channel is active. For each bit that is a zero (clear), the channel is inactive;

= c Clear list (write default information to all memory locations in list).

Default information is: Frequency = 2 MHz, DSP modes all '0' (zero) (null or pass-through operations and no filters), AGC & ALC modes = 1 (no or manual gain), Gain setting = 123, Squelch = 120, channel status = inactive;

= e Execute channel scanning. This command begins scan operations. This command will cause all other processing including another scan to be aborted.

Data-I contains a single character which indicates the scan mode

n = normal scan where scanning continues after a signal causes the scan to pause.

N = normal scan where scanning continues after a signal causes the scan to pause, and at the end of the list, F1F2 scanning will commence. So alternating between channel scanning and F1F2 scanning.

s = seek mode where the receiver stops the scan when an active signal is detected.

S = seek mode where the receiver stops the scan when an active signal is detected, but if no active signal is found and at the end of the list, F1F2 scanning will commence. So alternating between channel scanning and F1F2 scanning until a signal is found.

✍ **NOTE:** *Channel scan operations always resume from the channel following the channel aborted on. This allows a resume scan function by default. Any change to the frequency list's settings results in the next seek or scan to start with channel 00.*

= m Modify channel,

data-I contains two characters (0..9) of channel number,

This command causes the receiver to copy the current working parameters to the memory location indicated by the channel number. (This should be the last command used after setting the radio to the appropriate state for use as a frequency list entry);

= N Read name of frequency list;

= n Set name of frequency list,

data-I contains the list id (5 characters), followed by 9 characters of frequency list name;

= q Request the current channel number.

= r Recall channel,

data-I contains two characters (0..9) of channel number;

Copy the stored channel data to the current receiver working set.

= S Read channel status,

data-I contains two characters (0..9) of channel number;

= s Set channel status,

data-I contains two characters (0..9) of channel number, followed by a single status character:

a = active (to be included in a channel scan)

i = inactive (to be excluded from channel scan);

Returns: Acknowledge | Channel Information | Not acknowledge

7.3.1.10 Scan List

{ *Rx Id* [*Rx Id…*] **z** *function data-z CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;

z = Command character;

function = A single character indicating what scan list command is desired;

data-z = Character data associated with the scan list command;

CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;

CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

The Scan List command directs the Receiver to perform a scan list function. The actual function to perform is indicated in *function* as shown below. These commands are a typical set of list housekeeping commands. Any special functions using the frequency list will be handled elsewhere.

Function = a Abort (stop/pause) the currently active scan. If no scan is active, the command is ignored. If no list changes made, the next scan frequency will be the frequency logically following the one that was aborted;

= b Bulk status setting,

data_I contains 40 characters in the range of '@'..'_' (0x40..0x5f) where the five (5) Ls bits reflect the status for five consecutive scan entries. Scan entry 00 is the Ls bit of the first character. Scan entry 01 is the next higher Ls bit in the first character. And so on to channel 199 being the Ms bit of the five bits in the fortieth character. For each bit that is a one (set), the scan entry is active. For each bit that is a zero (clear), the scan entry is inactive;

= c Clear list (write default information to all memory locations in list).

Default information is: Start freq. = stop freq. = 2 MHz, channel status = inactive;

= e Execute F1F2 scanning. This command begins scan operations. This command will cause all other processing including another scan to be aborted.

Data-z contains a single character which indicates the scan mode

n = normal scan where scanning continues after a signal causes the scan to pause.

N = normal scan where scanning continues after a signal causes the scan to pause, and at the end of the list, channel scanning will commence. So alternating between F1F2 scanning and channel scanning.

s = seek mode where the receiver stops the scan when an active signal is detected.

S = seek mode where the receiver stops the scan when an active signal is detected, but if no active signal is found and at the end of the list, channel scanning will commence. So alternating between F1F2 scanning and channel scanning until a signal is found.

✍ **NOTE:** *F1F2 scan operations always resume from the frequency following the frequency aborted on, or, if a new frequency is set without changing the scan list, and that frequency is inside the current entry's F1F2 range, it will start from there. This allows a resume scan function by default. Any change to the scan list's settings results in the next seek scan to start with F1 of scan entry 000.*

= N Read name of scan list;

= n Set name of scan list,

data-z contains the list id (5 characters), followed by 9 characters of scan list name;

= q Request the current scan entry number;

= r Read Entry

data-z contains three characters (0..9) of scan entry number.

Causes the selected scan list entry contents to be returned to the requester. Also causes the radio to be set to the entry's settings (equivalent to Recall in channel scan);

= S Read channel status,

data-z contains three characters (0..9) of scan entry number;

= s Set scan entry status,

data-z contains three characters (0..9) of scan entry number, followed by a single status character

a = active (to be included in the F1F2 scan set)
i = inactive (to be excluded in the F1F2 scan set);

= w Write scan entry,

data-z contains three characters (0..9) of scan entry number, followed by the scan start and stop frequencies, which are eight (8) characters each, in the same format used by the tune command.

This command causes the F1 and F2 frequencies to be entered in the scan list, but does not check for validity of frequencies themselves, nor that F1 < F2. At the same time the other scan entry information (demodulation, filters gain control, step size, etc.) is taken from the current settings and stored in this entry's list position (this is the opposite of the "r" Read Entry command. (This should be the last command used after setting the radio to the appropriate state for use as a scan list entry).

Returns: Acknowledge | Channel Information | Not acknowledge

7.3.1.11 Request Status

{ *Rx Id* [*Rx Id…*] **q** *kind [mod] CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
q = Command character;
kind = A single character indicating what status portion is desired;
[mod] = Optional modifier used with some status requests;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

The Request Status command directs the Receiver to return the status and other useful information to the host. The host will wait a maximum of 500 ms before timing out.

Kind = a Current AGC mode;
= b Get most recent BITE result;
= c Get current signal flow control settings;
= f Synthesizer frequency;
= i Current BFO;
= m Current ALC mode;
= N DSP's currently active modules/tables ids;
= n DSP's currently active modules/tables names;
= p Get receiver state;
= R Radio state bits (the most recently setting of bits sent to the RF module);
= r RF level at current instance;
= t Current squelch setting;
= u Software version of μController;
= V Current volume (both channels);
= v Software version of DSP code. This needs to be followed by a DSP identification byte which must be ‘'0' or '1' ('1' only if DSP 1 is present);
=x Current manual gain setting.

Returns: Acknowledge | Not acknowledge

7.3.1.12 BITE/Test/Control

{ *Rx Id* [*Rx Id…*] **b** *function data-b CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
b = Command character;
function = A single character indicating what test command is desired;
data-b = Single character data associated with the test command;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

The BITE / Test / Control command allows the remote controller to execute various test functions and twiddle bits that normally would not be twiddled with.

Function = a Turn off attenuator ‘0’..’9’ as indicated by the next character–

= A Turn on attenuator ‘0’..’9’ as indicated by the next character–
- 0 - 12 dB RF front end;
- 1 - 18 dB 2nd IF;
- 2 - 6 dB 2nd IF;
- 3 - 12 dB 2nd IF;
- 4 - 24 dB 2nd IF;
- 5 - 6 dB 2nd IF;
- 6 - 12 dB 2nd IF;
- 7 - 24 dB 2nd IF;
- 8 - 6 dB 3rd IF;
- 9 - 30 dB optional front end. Also controls calibrator access to radio— when high calibrator tone reaches radio;

= b Turn off radio control bit as indicated by the next character–

= B Turn on radio control bit as indicated by the next character–
- c - Calibrator;
- i - IF detector switch;

= p Select preselector ‘0’..’5’ as indicated by the next character–
- 0 - 1.50 .. 3.00 MHz;
- 1 - 3.00 .. 5.25 MHz;
- 2 - 5.25 .. 8.50 MHz;
- 3 - 8.50 .. 13.25 MHz;
- 4 - 13.25 .. 20.00 MHz;
- 5 - 20.00 .. 30.00 MHz;

= s Select signal flow control settings as indicated by the next character–
- M - Main audio to monitor out;
- A - Auxiliary audio to monitor out;
- N - Audio monitor on line;
- F - Audio monitor off line;
- 0 - AUX_OUT to DSP1 ADC input;
- 1 - Lo Band IF to DSP1 ADC input;

= t Select BITE test '0' as indicated by the next character–
- 0 - Basic BITE;

Returns: Acknowledge | Not acknowledge

7.3.1.13 Greeting/Handshaking

{ *Rx Id* [*Rx Id…*] **g** *CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
g = Command character;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

The greeting command instructs the receiver to respond with an acknowledge. This allows the host to periodically poll all receivers and make a list of all receivers that are on-line. The host will wait a maximum of 500 ms before timing out. If the host does not receive a reply and times-out, it assumes that the receiver either does not exist, is off-line, or is broken.

Returns: Acknowledge | Not acknowledge

7.3.1.14 Reset DSP

{ *Rx Id* [*Rx Id…*] **r** 0|1 rRrR *CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
r = Command character;
0 = 0 or 1 indicates the DSP to reset;
rRrR = Reset confirmation characters, must be these characters;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 or CS Code 2.

The reset DSP command instructs the micro controller to reset the DSP and reload the initial boot code.

Returns: Acknowledge | Not acknowledge

7.3.1.15 Set Manual Gain Level

{ *Rx Id* [*Rx Id...*] **x** *Data-3 CS1 CS2* }

Where; Rx Id = See Table 7-1 for Rx Id;
x = Command character;
Data-3 = Three (3) characters that indicate the manual gain level desired, in -dBm units and ranges from '000'..'127';
CS1 = Ls 6 bits of CS code- See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code- See Table 7-1 for CS Code 2.

Set the manual gain level to the value entered. The number entered is the absolute receiver gain setting in minus dBm. In case of ISB, this gain setting applies to both USB and LSB. The manual gain is

used only when in manual gain mode (AGC is off). To obtain complete accuracy, the ALC must be set to manual gain also, otherwise it will still have a ±20 dB gain adjustment range.

Returns: Acknowledge | Not acknowledge

7.3.1.16 Load and Use Embedded Code

{ *Rx Id* [*Rx Id...*] **e** *Type Version CS1 CS2* }

Where;	Rx Id	=	See Table 7-1 for Rx Id;
	e	=	Command character;
	Type	=	Specify the code type (see below);
	Version	=	Specify which version of the particular type desired (see below);
	CS1	=	Ls 6 bits of CS code- See Table 7-1 for CS Code 1;
	CS2	=	Ms 6 bits of CS code- See Table 7-1 for CS Code 2.

Stop the execution of the current DSP algorithm related to the code type to be loaded and load the code from the EPROM attached to the micro controller. The type of the code is one of the following:

Type	= L	LO Band IF demodulation algorithms;
	= F	FIR Coefficient tables for high pass filters;
	= f	FIR Coefficient tables for low pass filters;
	= 0	Boot load default code to DSP0 (same as resetting it);
	= 1	Boot load code to DSP1

The version codes are a single character from the set 0..G (0x30..0x47) for type L, shown in Table 7-5, and the set 0.._, shown in Table 7-4, (0x30..0x5f) for the other types.

If type is ‘0’ then no version code is expected. The default boot load code will be downloaded.

If type is ‘1’ then the version indicates which module to boot load. The available versions for this type are 0 and 1.

The loading of a demodulation module will not affect the existing filter nor ALC settings. The loading of a filter will not affect the current demodulation mode nor ALC settings.

Returns: Acknowledge | Not acknowledge

7.3.2 Outgoing (From Receivers)

7.3.2.1 Receiver Status

{ **!** *Rx Id* **s** *Data-? CS1 CS2* }

Where:	Rx Id	=	See Table 7-1 for Rx Id;
	s	=	Command character;
	Data-?	=	Result data of the status command—see below for details;
	CS1	=	Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
	CS2	=	Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

The Receiver Status reply returns any of the following data: The Controller's software version code, the DSP's software code, current synthesizer frequency.

Result sections:

The current AGC mode:

Byte 1	=	a';
Byte 2	=	Single character code indicating current mode ('0'..'9');

Most recent BITE test result:

Byte 1	=	' b';
Byte 2	=	Test code # of most recently completed test ('0'..'9');
Bytes 3, 4	=	Result of most recently completed test as indicated by a code from '0'..'o', or '!', where '0' in both bytes means all pass; a '!' in both bytes shows if currently busy performing BITE; and any other combination means some kind of error. For details on BITE test results, see Table 7-6.

Signal Flow Control setting result:

Byte 1	=	'c';
Byte 2	=	'M' MAIN_OUT or 'A' AUX_OUT to monitor audio;
Byte 3	=	'N' On or 'F' Off signal to monitor audio;
Byte 4	=	'0' AUX_OUT or '1' Lo Band IF to DSP1 ADC.

Current Synthesizer frequency:

Byte 1	=	'f';
Bytes 2..8	=	Frequency from 10's of MHz to 1's of Hz. ASCII digits w/o formatting characters.

Current CW BFO:

Byte 1	=	'i';
Byte 2	=	'+' | '-' (depending on polarity);

Bytes 3..6 = Frequency from 1's of kHz to 1's of Hz. ASCII digits w/o formatting characters.

DSP's currently active modules/tables ids:

Byte 1 = 'N';
Byte 2 = Id of currently loaded and active demodulation module;
Byte 3 = Id of currently loaded and active low-pass FIR Coefficient table;
Byte 4 = Id of currently loaded and active high-pass FIR Coefficient table.

DSP's currently active modules/tables names:

Byte 1 = 'n';
Bytes 2..5 = Name of currently loaded and active demodulation module;
Bytes 6..9 = Name of currently loaded and active low-pass FIR Coefficient table;
Bytes 10..13 = Name of currently loaded and active high-pass FIR Coefficient table.

The current ALC mode:

Byte 1 = ' m';
Byte 2 = Single character code indicating current mode ('0'..'9');

The Receiver state:

Byte 1 = 'p';
Byte 2 = Id of currently loaded and active demodulation module;
Byte 3 = Id of currently loaded and active low-pass FIR Coefficient table;
Byte 4 = Id of currently loaded and active high-pass FIR Coefficient table;
Byte 5 = Single character code indicating current ALC mode ('0'..'9');
Byte 6 = Single character code indicating current AGC mode ('0'..'9');
Bytes 7..8 = Two character ASCII hex type result of the current manual gain setting;
Bytes 9..10 = Two character ASCII hex type result of the current squelch setting.

The Radio state:

Byte 1 = 'R';
Byte 2 = '9' if attenuator 9 is on or '.' if off.
Byte 3 = '8' if attenuator 8 is on or '.' if off.
Byte 4 = '7' if attenuator 7 is on or '.' if off.
Byte 5 = '6' if attenuator 6 is on or '.' if off.
Byte 6 = '5' if attenuator 5 is on or '.' if off.
Byte 7 = '4' if attenuator 4 is on or '.' if off.
Byte 8 = '3' if attenuator 3 is on or '.' if off.
Byte 9 = '2' if attenuator 2 is on or '.' if off.
Byte 10 = '1' if attenuator 1 is on or '.' if off.

Byte 11 = ‘0’ if attenuator 0 is on or ‘.’ if off.
Byte 12 = ‘I’ if IF Detector mode is on or ‘i’ if off.
Byte 13 = ‘C’ if calibrator is on or ‘c’ if off.
Byte 14 = ‘0’..’5’ indicating the currently selected preselector.

The just read RF amplitude value. The value read is inversely proportional to the signal strength. i.e., 0x64 means a signal level of –100 dBm, while 0x32 is a signal level of –50 dBm, 50 dBm stronger. The resolution is approximately ±2 dB. The first set will return Main (USB) channel RF level; the second set will return Aux. (LSB) channel RF level:

Byte 1 = ‘r’;
Bytes 2..3 = Hex-type data - See Table 7-1 for [data] (Main/USB);
Bytes 4..5 = Hex-type data - See Table 7-1 for [data] (Aux./LSB).

The current Squelch value:

Byte 1 = ‘ t’;
Bytes 2..4 = Three character BCD type result of the current squelch setting.

Controller Software Version data:

Byte 1 = ‘ u’;
Byte 2 = Count of characters in string—See Table 7-1 for [Length];
Byte 3..n = Text data—See Table 7-1 for [Data].

The current volume settings for both channels:

Byte 1 = 'V';
Byte 2..4 = Three character BCD type result of the current Main channel volume setting;
Byte 5..7 = Three character BCD type result of the current Aux. channel volume setting.

DSP Software Version data:

Byte 1 = ‘ v’;
Byte 2 = DSP id (‘0’ | ‘1’);
Byte 3 = Count of characters in string—See Table 7-1 for [Length];
Bytes 4..n = Text data—See Table 7-1 for [Data].

The current Manual Gain setting:

Byte 1 = 'x';
Byte 2..4 = Three character BCD type result of the current manual gain level setting.

7.3.2.2 Frequency List

{ **!** *Rx Id* **I** *Data-I CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
I = Command character;
Data-I = Character data associated with the function—see below for details;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Returns data related to the frequency list. The type of data returned is dependent on the function, see below for functions.

Result sections:
Name and ID of frequency list:
Byte 1 = N';
Bytes 2..6 = contains the Id of the frequency list;
Bytes 7..15 = contains the name of the frequency list;

Current channel number:
Byte 1 = 'q';
Bytes 2..3 = contains the channel number;

Channel status:
Byte 1 = ' S';
Bytes 2..3 = contains the channel number;
Byte 4 = status code of this channel ('i' or 'a');

7.3.2.3 Scan List

{ **!** *Rx Id* **z** *Data-z CS1 CS2* }

Where: Rx Id = See Table 7-1 for Rx Id;
z = Command character;
Data-z = Character data associated with the function—see below for details;
CS1 = Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
CS2 = Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

Returns data related to the scan list. The type of data returned is dependent on the function, see below for functions.

Result sections:

Name and ID of scan list:

Byte 1	=	‘N’;
Bytes 2..6	=	contains the Id of the scan list;
Bytes 7..15	=	contains the name of the scan list;

Current scan entry number:

Byte 1	=	‘q’;
Bytes 2..4	=	contains the scan entry number;

Scan entry contents:

Byte 1	=	‘ r’;
Bytes 2..4	=	contains the scan entry number;
Bytes 5..12	=	Start frequency (in the same format as used by the tune frequency command),
Bytes 13..20	=	Stop frequency (in the same format as used by the tune frequency command);

Scan entry status:

Byte 1	=	S’;
Bytes 2..4	=	contains the scan entry number;
Byte 5	=	status code of this scan entry (‘i’ or ‘a’);

7.3.2.4 Acknowledge

{ **!** *Rx Id* **a** *Data-1 CS1 CS2* }

Where:	Rx Id	=	See Table 7-1 for Rx Id;
	a	=	Command character;
	Data-1	=	Command code for which the ACK applies;
	CS1	=	Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
	CS2	=	Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

This is the reply to any successfully executed command. The data block contains the Command code of the command just executed.

7.3.2.5 Not Acknowledge

{ **!** *Rx Id* **n** *Data-2 CS1 CS2* }

Where:	Rx Id	=	See Table 7-1 for Rx Id;
	n	=	Command character;
	Data-2	=	Command code for which the NAK applies. An error code;
	CS1	=	Ls 6 bits of CS code—See Table 7-1 for CS Code 1;
	CS2	=	Ms 6 bits of CS code—See Table 7-1 for CS Code 2.

This is the reply to any command that was not successfully executed. The data block contains the Command code of the command which failed to be executed and the associated error code.

7.3.3 Settings, Codes, and Command Samples

Table 7-3 AGC and ALC Settings

AGC Setting	ALC Setting	Description
0	0	Factory Test
1	1	Manual
2	2	Slow (4 Sec)
3	3	Medium
4	4	Fast
5	5	Slow Data

Table 7-4 Bandwidth Selection

High Pass Filter Code	Low Pass Filter Code	Filter	Description
2	1	6 kHz	6 kHz filter selection, uses both high and low pass. Typical AM.
0	3	2.5 kHz	Low pass only. Typical SSB
0	4	2.7 kHz	Low pass only. Typical ISB
0	5	0.3 kHz	Low pass only. Typical CW
0	7	0.5 kHz	Low pass only. Typical CW
0	9	1.0 kHz	Low pass only. Typical CW
0	;	2.4 kHz	Low pass only. Typical CW
0	<	2.2 kHz	Low pass only. Typical SSB
0	=	2.7 kHz	Low pass only. Typical SSB
0	>	3.1 kHz	Low pass only. Typical SSB
0	?	3.0 kHz	Low pass only. Typical SSB
0	@	3.2 kHz*	Low pass only. Typical SSB
0	A	3.6 kHz*	Low pass only. Typical SSB
0	B	4.0 kHz*	Low pass only. Typical SSB

NOTES: 1. *If AM detection mode selected for any of the filter types the high pass filter selection (2) should be also selected.*
2. *High Pass Filter may not be used with Low Pass Filter 1 kHz and below.*
**Available only with Dual-DSP versions.*

Table 7-5 Demodulation Selection

Demodulation Code	Description
1	AM
2	CW

Table 7-5 Demodulation Selection

Demodulation Code	Description
3	USB
4	LSB
5	ISB

Table 7-6 BITE Returned Error Codes

Error Code	Bit Position	Description
00110001	(1)	Power supply over temperature condition
00110010	(2)	Error in detecting receiver noise floor
00110100	(4)	Error in detecting calibration signal
00111000	(8)	Synthesizer out of lock condition
01000000	(@)	DSP Error
01010000	(P)	Power Supply, DC voltages out of range

Table 7-7 Sample Command Sequence

Step #	From Host to Rx	Reply from Rx	Comment
1	{Ag◊◊}	{!AagZ4}	Send greeting (optional)
2	{Af15000000◊◊}	{!AafY4}	Set frequency to 15 MHz
3	{AeL3◊◊}	{!AaeX4}	Load USB demodulator
4	{Aef3◊◊}	{!AaeX4}	Load SSB filter
5	{Am4◊◊}	{!Aam‘4}	Set ALC to fast
6	{Aa4◊◊}	{!AaaT4}	Set AGC to fast
7	{At127◊◊}	{!Aatg4}	Set squelch threshold to OFF
8	{Ai+1000_ _}	{!Aai\4}	Set BFO to 1 kHz

✍ **NOTES:** 1. *The commands above assume that there is a single Receiver, and its id is ‘A’.*
2. *◊◊ is the appropriate checksum.*

7.3.3.1 Commands Available for Standard Pan:

Input Commands (to Receiver Serial Port 2)

Set data port baud rate Code: “space” Length 1 Data: 0..3

0 115,200
1 57,600
2 38,400
3 19,200 (default)

Example: {Ao !01 }

Set function Code: ! Length: 1 Data 0..3

0 Null
No further calculations made.
1 Max Hold
Save maximum value encountered.
2 Geometric Average- Linear
Take a geometric average of the samples before log conversion takes place.
3 Geometric Average - Log
Take a geometric average of the samples after log conversion takes place.

Example: {Ao!!02 }

Set output Code: ” Length: 1 Data: 0..4

0 Standard
128 data bytes
1 Standard w/noise floor
128 data bytes followed by one byte containing the value of 30th percentile bin.
2 Standard w/64 bin noise floor
128 data bytes followed by one byte containing the value of 30th percentile bin of center 64 bins
3 5 kHz
64 data bytes centered on 5 kHz
4 5 kHz w/noise floor
64 data bytes centered on 5 kHz followed by one byte containing the value of the 30th percentile bin.

Example: {Ao”!02 }

Perform FFT ?

Output Command (from Receiver Serial Port 2)

String 128 Bytes in length

Example

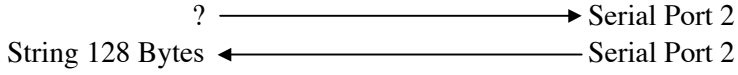


Table 7-8 Error Codes Returned with NAK Command

!	Too busy to handle command. Try again later.
#	Bad data length code (should be between 'space' and 'z').
$	Bad checksum received with this command.
(	DSP0 hardware missing. Either not responding because of a problem, or simply just not installed.
)	DSP1 hardware missing. Either not responding because of a problem, or simply just not installed.
*	Command code out of range of the allowed characters.
+	No sign character found. Expected a sign character ('+', '-', or ' ')
1	Waiting for DSP0 timed out. This could be because there is something wrong with the DSP0, or the byte count did not match what the DSP0 expected, or the data format of the boot code is wrong.
2	Character count outside approved limit. This error may occur because of bad coding if it was from an embedded call, or the remote control device made a mistake.
3	Routine name not found in table. Check if every character is a valid 7-bit ASCII character and there are no invisible characters to mess things up.
4	Illegal bank number in table!! This is a table construction problem and should never happen.
5	EPROM address of code is out of range!! This is a table construction problem and should never happen.
6	Byte count too high!! This is a table construction problem and should never happen.
7	DSP did not start boot load after interrupt. Either the DSP is running super slow, or there is something wrong with it.
8	Illegal character found for sequence number in Download DSP0 Code, Continuation.
9	Sequence number of order in Download DSP0 Code, Continuation.
:	Required an even number for nibble count. Got an odd number.
;	Expected a HEX character--must have been something else.
<	DSP0 software missing. Either not responding because of a problem, or simply just not installed.
>	DSP1 software missing. Either not responding because of a problem, or simply just not installed.
?	Command code out of range of the allowed characters.
A	Illegal sub-code to the scan list command received. Don't know what to do with it.
a	Illegal channel status character found. Expected a character 'i' or 'a'.
B	Illegal BCD character. Expected a BCD type character ('0'..'9').
b	BITE test with this sub-code not (yet) implemented.
C	Illegal frequency digit found. Expected a character in the range of '0'..'9'.
c	Illegal confirmation string--reset not performed.
D	Expected a decimal type digit: '0'..'9'
d	Illegal digit indicator received--valid ones are from A..H or a..h.

Table 7-8 Error Codes Returned with NAK Command

E	Bad or unused entry in the sizes table.
e	Illegal status code found for BITE or Test.
F	Illegal channel digit found. Expected a character in the range of ’0’..’9’.
f	Illegal frequency digit found. Expected a character in the range of ’0’..’9’.
G	Illegal mode character found. Expected the character ’n’ or ’s’
H	Expected a hex type digit: ’0’..’9’, ’a’..’f’, or ’A’..’F’
h	Illegal step value received.
I	Illegal command has been detected. Don’t know what to do with it.
J	Illegal channel status character found. Expected character ’i’ or ’a’.
j	Illegal DSP id. (Must be ’0’ or ’1’.)
L	Illegal channel digit found. Expected a character in the range of ’0’..’9’.
l	Illegal sub-code to the frequency list command received. Don’t know what to do with it.
m	Illegal mode character found. Expected the character ’n’ or ’s’.
N	Index out of range. Expected a BCD type character (’0’..’9’)
O	Value given out of range.
Q	Bad data found as part of the bulk code data stream.
R	Frequency requested out of acceptable range.
r	Illegal sub-code found for BITE or Test.
S	Command string length either exceeded or not completely used.
s	Illegal sub-code to the status command received. Don’t know what to do with it.
T	Type version out of range.
t	Illegal embedded code type.
u	Illegal offset to micro-controller variable.
V	Illegal version length received from DSP.
v	Illegal offset to "fixed location" DSP0 variable.
X	Either DSP missing in action. Either not responding because of a problem, or simply just not installed.
x	Something bad happened on the way to transferring ALC variables to the DSP0.
y	Read RF level & Step command with this sub-code not legal.
[	DSP0 does not acknowledge.
\	Squelch value entered was too low (less than -SQUELCH LIMIT). Remember, the ’-’ (minus sign) is implied.
]	DSP1 does not acknowledge.

8. HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN

8.1 Introduction

8.1.1 General

This section is the Illustrated Parts Breakdown for the Model 8174 Receiver. Because the Receiver exists in more than one hardware configuration, several similar (but different) parts lists may be included for the same item. Thus, the user must be aware of the exact part number of the equipment in order to find the correct part list, wire list or assembly drawing. Check the instrument ID tag for the correct top assembly part number.

8.1.2 Parts Lists

The Parts Lists consist of a breakdown of the hardware configurations, all board cables, and detail parts. The top level parts list(s) is provided first. Boards follow, arranged in ascending sequence numbers of the boards. Cables are grouped together at the end of the parts lists. The date of the parts list is provided in the upper left corner. Each parts list is provided with a title, part number, and revision level in appropriate title boxes. Eight columns of information are used in this format as explained below in **A** through **H.**

1. ITEM. This identifies the parts as they are called out on the Assembly Drawing.
2. PART No. This is the part number of the item.
3. DESCRIPTION. This provides a brief description of the item so that it can be easily identified.
4. MFG. No. This supplies the part number used by the original manufacturer.
5. SPECIAL HANDLING CHARACTERISTICS. The "HC" column identifies a single letter code that indicates special characteristics of certain parts. These codes are:

   C: CAUTION, HANDLE WITH CARE. These items can cause injury to personnel if handled carelessly.

   F: FRAGILE. These items are subject to damage if dropped or jarred.

   H: HEAT SENSITIVE. These items can be damaged if overheated.

   P: SPECIAL HANDLING/PACKAGING. Special attention should be paid to handling details of these items.

   T: LIMITED SHELF LIFE. These items deteriorate in quality over time.

   Y: STATIC SENSITIVE. These devices can be destroyed by static discharge.
6. CODE I.D. This column shows the five digit number denoting the Commercial and Government Entity (CAGE) code assigned by cataloging handbook H4. A list of these codes is supplied in Table 8-1.
7. QTY. This refers to the number of items required for each assembly.

8. REF. DESIG. This is the reference designator of that part within the unit.

8.1.3 Wire Lists

Each Wire List uses a format describing the Wire number, Color code, From and To connections and Remarks when necessary. In the columns "From" and "To", the number following the dash refers to a pin, i.e., E2-1 refers to pin 1 of terminal E2. In some cases notes have been added to clarify connections.

8.1.4 Assembly Drawings

Assembly Drawings are used in conjunction with the Parts Lists to identify particular parts as they are located within the instrument. The drawings of the top level instruments are shown first, and then the other drawings are ordered sequentially by part number.

Table 8- 1 Cage Codes

0AUF8 Optima Enclosures
2166 Mt. Industrial Pkwy.
Tucker, GA 30084

0A8M9 Euro-dip Inc,
1545 W. University Dr.
Tempe, AZ 85281

0BYG1 Tadrian Electronic Industries, Inc.
40 Seaview Blvd.
Port Washington, NY 11050

0BZ13 Resonant Power Technology, Inc.,
1926 Junction Ave.
San Jose, CA 95131-2102

0B089 Dallas Semiconductor Corp.
4350 Beltwood Pkwy.
Dallas, TX 75244

0B3E0 ASM Co.
Metals Park, OH 44073-9989

0C8Z7 Sanyo Energy Corp.
Battery Division
200 Riser Rd.
Little Ferry, NJ 07643

0D2A6 Mitsubishi Electric
991 Knox St.
Torrance, CA 90502

0F8X6 Super Tek Electronics
543 W. Algonquin Rd.
Arlington Heights, IL 60005

0GP12 Radiall Inc.
150 Long Beach Blvd.
Stratford, CT 06497

0GUG6 Ecliptek Corp.
(Ecliptek)
18430 Bandilier Circle
Fountain Valley, CA 92708

0MS63 Quality Technologies Corp.
610 N. Mary Ave.
Sunnyvale, CA 94086

0KDP7 Fenwal Inc.
400 Main St.
Ashland, MA 01721-2150

00144 ADC Telecommunications, Inc.
4900 W. 78th St.
Minneapolis, MN 55435-5410

00213 Nytronics Components Group, Inc.
Orange St.
Darlington, SC 29532

00216 Loctite Corp.
705 N. Mountain Rd.
Newington, CT 06111-1411

00222 ESC Electronics Corp.
534 Bergen Blvd.
Palisades Park, NJ 07650-2322

00853 Sangamo Electric Co.
(Sangamo)
South Carolina Div.
Pickens, SC 29671

01121 Allen Bradley Co.
(AB)
1201 South 2nd St.
Milwaukee, WI 53204

01139 General Electric Co.,
(GE Sil)
Silicone Products Dept.
Waterford, NY 12188

01281 TRW, Inc.,
Semiconductor Div.
(TRW Semi)
14520 Aviation Blvd.
Lawndale, CA 90260

01295 Texas Instruments, Inc.,
Semiconductor Components Div.
(TI)
13500 N. Central Expwy.
Dallas, TX 75231

01766 International Crystal Mfg. Co., Inc.
(Intrnl Xtal)
10 N. Lee Ave.
Oklahoma City, OK 73102

02111 Hamilton Standard Controls
Spectrol Div.
17070 E. Gale Ave.
P.O. Box 1220
City of Industry, CA 91749

02598 Aeroflex Laboratories, Inc.
Rotating Components Div.
35 S. Service Rd.
Plainview, NY 11803-4101

02660 Bunker Ramo Corp.,
Amphenol Connector Div.
(Amphenol)
2801 S. 25th Ave.
Broadview, IL 60153

02735 RCA Corp.,
Solid State Div.
(RCA Solid)
Route 202
Somerville, NJ 08876

03355 Roberts, E.V. and Ass., Inc.
(Roberts)
9601 Jefferson Blvd.
Culver City, CA 90230

03516 General Electric Co.,
Meter Product Div.
(GE Meter)
130 Main
Somersworth, NH 03878

03765 Automatic Coil Corp.
Sub of Designotronics, Inc.
3545 S.W. 71st St.
Miami, FL 33147-6517

04009 Arrowhart, Inc.
(Arrowhart)
103 Hawthorne St.
Hartford, CT 06106

04026 JA Weaver (ITT)
St. Louis, MO 65000

04164 Raytheon Co.,
(Raytheon)
Missile System Div.
Bedford, MA 01730

04213 Caddell Burns Mfg. Co.
258 E. 2nd St.
Minneola, NY 11501

04222 Aerovox Corp.
(Aerovox)
19th Ave South
P. O. Box 867
Myrtle Beach, SC 29577

04264 Circon Component Corp.
(Circon Comp)
Santa Barb. Municipal Airport
Goleta, CA 93017

04347 The Dexter Corp.,
Hysol Div.
Olean, NY 14760

04426 Licon,
Div. of Il. Tool Works
6615 W. Irving Pk. Rd.
Chicago, IL 60634

04544 Dynapar Corp.
Sub. of Chicago Pneumatic Tools
(Dynapar)
1675 Delaney R.
Guernee, IL 60031

04618 AMP Special Ind.,
Div. of Amp Products Corp.
(AMP Spec)
Valley Forge, PA 19482

04681 Becton Dickinson and Co.
Huntington Research Div.
P.O. Box 527
Brooklandville, MD 21022

04713 Motorola Semiconductor Products, Inc.
(Motorola)
5005 E. McDowell Rd.
Phoenix, AZ 85008

04729 Unicorp
291 Cleveland St.
Orange, NJ 07050-2817

04946 Standard Wire and Cable Co.
(Std Wire)
2345 Alaska Ave.
El Segundo, CA

04967 Fastener Specialty, Inc.
(Fastnr Spec)
3640 W. Pioneer Parkway
Arlington, TX 76013

05236 Jonathon Engr.
1101 S. Acacia Ave.
Fullerton, CA 92631-5312

05245 Corcom, Inc.
1600 Winchester Rd.
Libertyville, IL 60048

05277 Westinghouse Electric Corp.,
(Westinghouse)
Semiconductor Dept.
Youngwood, PA 15697

05464 Industrial Electronic Engineers Inc.
7720 Lemona Ave.
Van Nuys, CA 91405

05574 Viking Ind., Inc.
(Viking)
21001 Nordoff St.
Chatsworth, CA 91311

05593 Icore Intl. , Inc.
180 N. Wolfe Rd.
P.O. Box 505
Sunnyvale, CA 94086-5211

05820 Wakefield Engineering, Inc.
(Wakefield)
Audubon Rd.
Wakefield, MA 01880

06090 Raychem Corp.
(Raychem)
300 Constitution
Menlo Park, CA 94025

06324 Glenair, Inc.
(Glenair)
1211 Airway
Glendale, CA 91201

06383 Panduit Corp.
17301 Ridgeland
Tinley Park, IL 60477

06402 ETA Circuit Breakers
7400 N. Croname Rd.
Chicago, IL 60648-3902

06540 Amatom Electric Hardware,
Div. of Mite Corp.
(AEH)
81 Rockdale Ave.
New Rochelle, NY 10802

06666 General Devices
1410 South Post Rd.
Indianapolis, IN 46239

06682 Perfection Mica Co.
Magnetic Shield Div.
740 N. Thomas Dr.
Bensenville, IL 60106-1625

06776 Robinson-Nugent
800 8th St.
New Albany
IN 47150-3264

06915 Richco Plastic Co.
(Richco)
5825 N. Tripp
Chicago, IL 60646-6013

06961 Vernitron Electrical Components,
Beau Products Div.
(Vernitron)
117 Union Ave.
Laconia, NH 03246

07126 The Digitran Co.
(Digitran)
855 S. Arroya Pkwy.
Pasadena, CA 91109

07263 Fairchild Semiconductor
10400 Ridgeview Ct.
Cupertino, CA 95014

07294 Genisco Electronics Corp.
817 Pacific Rim Ct.
P. O. Box 431478
San Diego, CA 92143-1478

07385 Biro Manufacturing Co.
1114 Main St.
Marblehead, OH 43440

07700 Technical Wire Products, Inc.
(Tech Wire)
129 Dermody St.
Cranford, NJ 07016

07933 Raytheon
Semiconductor Div.
350 Ellis St.
Mt. View, CA 94042

08111 MF Electronics
(MF Elect)
527 Waverly Ave.
Mamoroneck, NY 10543

08289 Blinn Delbert Co., Inc.
1678 E. Mission Blvd.
P.O. Box 2007
Pomona, CA 91769-5065

08524 Deutsch Fastener Corp.
(Deutsch Elec)
7001 W. Imperial Hwy.
Los Angeles, CA 90009

08717 The Sloan Co.
(Sloan)
P. O. Box 367
7704 San Fernando Rd.
Sun Valley, CA 91352

08771 General Electric Co.
Mobile Communications Business Div.
Mountain View Rd.
P.O. Box 4164
Lynchburg, VA 24502

08779 Signal Transformer
(Signal Trans)
500 Bayview Ave.
Dept. EM

Inwood, NY 11696

08992 AGM Container Controls, Inc.
3526 E. Ft Lowell Rd.
P.O. Box 40020
Tucson, AZ 85717

09097 Wyle Labs
Electronic Enclosure Div.
225 Aviation Blvd.
El Segundo, CA 90245-4604

09150 Ampex Corp.,
Memory Products Div.
200 N. Nash St.
El Segundo, CA 90245

09213 General Electric,
Semiconductor Products Dept.
(GE Semi)
West Genesee St.
Auburn, NY 13021

09353 C & K Components, Inc.
(C & K)
103 Morse St.
Watertown, MA 02172

09922 Burndy Corp.
1 Richards Ave.
Norwalk, CT 06856

09969 Dale Electronics, Inc.,
Sioux Div.
(Dale Elec)
P. O. Box 180
East Hwy. 50
Yankton, SD 57078

1CJ86 Bossard International
115 Heritage Ave.
Portsmouth, NH 03801

1D666 Solitron Devices Inc.
Solitron/Microwave Div.
1177 Blue Heron Blvd.
Riviera Beach, FL 33404

1ES66 Maxim Integrated Products
120 San Gabriel Dr.
Sunnyvale, CA 94086

1HY41 American Relays Inc.
10306 Norwalk Blvd.
Santa Fe Springs, CA 90670

1W476 Whitehall Corp.
Crystek Crystals Corp. Div
2371 Crystal Dr.
P.O. Box 6135
Fort Meyers, FL 33906

1W698 Siemens Components Inc.
186 Wood Ave.
Iselin, NJ 08830-2704

1W947 Allkay Electronics Inc.
(Allkay)
9732 Variel
Chatsworth, CA 91313

10003 Grant Hardware Co.,
Div. of Grant Industries
1175 S. Jellick Ave.
City of Industry, CA 91746

10110 Optima Enclosures,
Div. of Scientific Atlanta Inc.
P. O. Box 1179
Los Altos, CA 94022

10226 Electronic Navigation Ind.
(Electr Nav)
3000 Winton Rd. South
Rochester, NY 14623

10400 Airborn, Inc.
4321 Airborn Dr.
Addison, TX 75001

11139 Deutsch Co., Electronic Comp.
(Deutsch Elec)
Municipal Airport
Banning, CA 92220

11532 Teledyne Relays,
A Teledyne Co.
(Teledynrelay)
3155 W. El Segundo Blvd.
Hawthorne, CA 90250

11851 Daniels Mfg. Corp.
(Daniels)
2266 Franklin Rd.
Bloomfield Hills, MI 48013

11869 Sangamo West, Inc.,
Micro Sonic Div.
(Sangamo)
60 Winter St.
Weymouth, MA 02188

12212 Bridgeport Insulated Wire Co.
51 Brookfield Ave.
Bridgeport, CT 06610-3004

12324 Stake Fastener Co.,
Div. of Dupree, Inc.
(Stake Fast)
9835 Dupree St.
S. El Monte, CA 91733

12517 Component Research Co., Inc.
1655-26 St.
Santa Monica, CA 90404-4016

12617 Hamlin Inc.
(Standish-Hamlin)
Grove and Lake Sts.
Lake Mills, WI 53551

12619 Electronic Development Corp.
(Electr Devlp)
11 Hamlin St.
Boston, MA 02127

12697 Clarostat Mfg. Co.
Lower Washington St.
Dover, NH 03820

12856 Micrometals
1190 N. Hawk Cir.
Anaheim, CA 92807

12881 Metex Corp.
970 New Durham Rd.
Edison, NJ 08817-2214

12969 Unitrode Corp.
(Unitrode)
580 Pleasant St.
Watertown, MA 02127

13050 The Potter Co.
(Potter)
P. O. Box 337
N. Hwy. 51
Wesson, MS 39191

13103 Thermalloy Co.
(Thermalloy)
8717 Diplomacy Row
Dallas, TX 75247

13454 Whitehall Corp.
Crystek Crystals Corp. Div.
2371 Crystal Dr.
P.O. Box 6135
Fort Meyers, FL 33906

13556 TRW Cinch Connectors
(TRW Cinch)
8821 Science Center Rd.
New Hope, MN 55428

13571 Electronic Research Co.
Sub of Q-Tech Corp.
7618 Wedd St.
Overland Park, KS 66204-2227

13619 R. F. Interonics, Inc.,
Div. of KDI Navcor, Inc.
(RF Inter)
100 Pine Aire Dr.
Bayshore, NY 11706

13636 Barry Wright
Controls Division
2323 Valley St.
P.O. Box 7710
Burbank, CA 91505

13764 Micro Plastics Inc.
Hwy. 178 N.
Flippin, AR 72634

13862 Alasco Rubber & Plastics Corp.
(Alasco)
617 Mt View Ave.
Belmont, CA 94002

14283 Matrix Science Corp.,
Sub of Amp Inc.
455 Maple Ave.
Torrance, CA 90503-3807

14304 Harris Corp.
R F Communications Group
1680 University Ave.
Rochester, NY 14610-1839

14482 Watkins-Johnson Co.
3333 Hillview Ave.
Palo Alto, CA 94304-1204

14604 Elmwood Sensors, Inc.
(Elmwood Sens)
1655 Elmwood Ave.
Cranston, RI 02907

14655 Cornell Dublier,
ElectronicsDiv.
(Cornell Dub)
Federal Pacific Electric Co.
50 Parts St.
Newark, NJ 07105

14726 Interconnection Products Inc.
1601 N. Powerline Rd.
Pompano Beach, FL 33069-1622

14752 Electro Cube, Inc.
(Electro Cube)
1710 S. Del Mar Ave.
San Gabriel, CA 91776

14936 General Instruments
(G.I.)
Power Semiconductor Div.
600 W. John St.
Hicksville, NY 11802-0709

14949 Trompeter Electronics
(Trompeter)
8936 Comanche Ave.
Chatsworth, CA 91311

15454 Ketema Inc.Rodan Div.
(Ketema-Rodan)
2905 Blue Star St.
Anaheim, CA 92806

15476 Digital Equipment Corp.
(Digital Equi)
146 Main St.
Maynard, MA 01754

15513 Data Display Products
303 N. Oak St.
Los Angles, CA 90302

15542 Mini Circuits Laboratory,
Div. of Scientific Components Corp.
(Mini Cir Lab)
2913 Wuentin Rd.
Brooklyn, NY 11229

15605 Cutlerhammer, Inc.
(Cutlerhammer)
4201 N. 27th St.
Milwaukee, WI 53216

15636 Elec-Trol Inc.
(Electrol)
9115 Brown Deer Rd.
San Diego, CA 92121

15686 Disc Instruments Inc.
102 E. Baker St.
Costa Mesa, CA 92626-4503

15851 Whitmore Plastic Wire and Cable Corp.
(Wirenetics)
27737 Avenue Hopkins
Valencia, CA 91355-1223

15912 Digital Sensors, Inc.
(Digital Sens)
4127 N. Figueroa Blvd.
Los Angeles, CA 90065

16179 Omni Spectra
24600 Hallwood Ct.
Farmington, MI 48024

16237 Connector Corp.
(Conn Corp)
6025 N. Keystone Ave.
Chicago, IL 60646

16299 AVX Corp.
Raleigh Plant
3900 Electronics Dr.
Raleigh, NC 27604-1620

16575 Sonetronics Inc.
1718 H St. N.
Belamr, NJ 07719

16733 Cablewave Systems, Inc.
60 Dodge Ave.
North Haven, CT 06473-1124

16956 Dennison Mfg. Co.
(Dennison)
300 Howard St.
Framingham, MA 01701

17117 Electronics Molding Corp.
(EMC)
96 Mill St.
Woonsocket, RI 02895

17304 Damon Corp.
Electronics Div.
80 Wilson Way
Westwood, MA 02090-1806

17504 Aluminum Filter Co.
(Alfco)
550 Maple Ave.
Carpinteria, CA 93013

17856 Siliconix, Inc.
(Siliconix)
2201 Laurelwood Rd.
Santa Clara, CA 95054

17954 Ball Bros. Research Corp.,
Miratel Electronics Div.
(Ball Miratel)
3600 Richardson N. W.
New Brighton, MN 55112

18038 LJ Technical Systems
19 Power Dr.
Hauppauge, NY 11788-4299

18076 Umpco, Inc.
(Umpco)
331 Vineland Ave.
City of Industry, CA 91746

18310 Concord Electronics Corp.
30 Great Jones St.
New York, NY 10012-1115

18324 Signetics Corp.
(Signetics)

811 E. Arques Ave.
Sunnyvale, CA 94086

18542 Wabash Inc.
Relay and Electronics Div.
1st and Webster Sts.
PO Box 708
Wabash, IN 46992

18565 Chomerics, Inc.
(Chomerics)
77 Dragon Ct.
Woburn, MA 01801

18612 Vishay Resistive
Systems Group
(Vishay)
63 Lincoln Hwy.
Malvern, PA 19355

18677 Scanbe Mfg. Co.
Div. of Canoga Ind.
3445 Fletcher Ave.
El Monte, CA 91731

18736 Voltronics Corp.
(Voltronics)
West St.
Hanover, NJ 07936

18915 Birtcher Corp.
(Birtcher)
4501 N. Arden Dr.
El Monte, CA 91731

19080 Robison Electronics Inc.
(Robison Elec)
2134 W. Rosecrans Ave.
Gardena, CA 90249

19209 General Electric Co.,
Battery Business Section
(GE Battery)
P.O. Box 114
Gainesville, FL 32601

19647 Caddock Electronics Inc.
1717 Chicago Ave.
Riverside, CA 92507-2302

19701 Mepco/Electra, Inc.
North American Philips
Mineral Wells, TX

19710 McMaster Products Corp.
(McMaster)
4200 W. Victoria
Chicago, IL

2D085 New Jersey Semiconductor
Products
20 Commerce St.
Springfield, NJ 07081-3004

2H631 Amp, Inc.
Federal Systems Business
Group
1250 E. Main St. Rt. 230
Mt. Joy, PA 17552-9314

2H935 Dupont
Photosystems and Electronic
Products Dept.
666 Driving Park Ave.
Rochester, NY 14603

2M589 Chemtronics, Inc.
8125 Cobb Center Dr.
Kennesaw, GA 30144

2W944 Papst Mechatronic Corp.
Aquidneck Industrial Park
Newport, RI 02840

20462 Prem Magnets Inc.
3521 N. Chapel Hill Rd.
McHenry, IL 60050

21022 Connor Winfield Corp.
1865 Selmarten Rd.
Aurora, IL 60505

21604 Buckeye Stamping Co.
(Buckeye)
555 Marion Rd.
Columbus, OH 43207

21807 The Hall Co.
240 E. Water St.
P.O. Box 38158
Urbana, OH 43078-2163

21821 Valpey-Fisher Corp.
(Valpey-Fisher)
75 South St.
Hopkinton, MA 01748-2204

21912 Anzac Electronics,
Div. of Adams-Russell Co., Inc.
(Anzac Elec)
39 Green St.
Waltham Heights, MA 02154

21921 RCA, Dist. and Special
Prod. Div.
(RCA Spec Prod)
2000 Clements Brd. Rd.
Deptford, NJ 08096

22229 Solitron Devices, Inc.
(Solitron)
8808 Balboa Ave.
San Diego, CA 92123

22526 Berg Electronics, Inc.
(Berg Elec)
Youk Expressway
New Cumberland, PA 17070

22929 Dale Electronics, Inc.,
Frequency Control Group
(Dale Freq)
1155 23rd St.
Tempe, AZ 85282-1822

23042 Texscan Corp.
(Texscan)
2446 N. Shadelane Ave.
Indianapolis, IN 46219

23050 Product Componets Corp.
30 Lorraine Ave.
Mt. Vernon, NY 10553-1222

23386 Racal Communications, Inc.
5 Research Pl.
Rockville, MD 20850-3213

23657 Shakespeare Co.
Electronics and Fiberglass
Div. of Anthony Industries
P.O. Box 733
Newberry SC 29108-8903

23663 Josyln Electronic System Div.,
Josyln Mfg. and Supply
(Josyln Elec)
6868 Cortona Dr.
Goleta, CA 93017

23875 M-Tron Industries
100 Douglas St.
Yankton, SD 52078-4430

23880 Stanford Applied
Engineering, Inc.
(SAE)
340 Martin Ave.
Santa Clara, CA 95050

23936 Pamotor, Inc.
(Pamotor)
312 Seventh St.
San Francisco, CA 94103

24253 ITT Pomona Electronics
1500 E. 9th St.
Pomona, CA 91766-3835

24355 Analog Devices, Inc.
(Analog Dev)
Rt 1, Industrial Pkwy.
Norwood, MA 02062

24444 General Semiconductor
(Gen Semicond)
230 W. 5th St.
Tempe, AZ 85281

24672 Austron, Inc.
(Austron)
10214 N. Interregional Hwy.
Austin, TX 78753

24759 Lenox-Fugle Electronics, Inc.
100 Sylvania Pl.
South Plainfield, NJ 07080-1448

24805 ESC, Inc. (MIL)
750 W. Ventura Blvd.
Camarillo, CA 93010

24931 Specialty Connector Co.
(Spec Conn)
3560 Madison Ave.
Indianapolis, IN 46277

24995 Environmental Container Co.
(Environ Con)
3560 Rouge River Hwy.
Grants Pass, OR 97526

25088 Siemens Corp.
286 Wood Ave. S.
Iselin, NJ 08830-2704

25120 Piezo Technology Inc.
2400 Diversified Way
P. O. Box 7877
Orlando, FL 32804

25330 General Connector Corp.
Div. of Pyle-National
9 Queen Anne Ct.
Langhorne, PA 19047

26419 Apex Airtronics, Inc.
2465 Atlantic Ave.
Brooklyn, NY 11207-2305

26629 Frequency Sources Inc.
Sources Div.
Sub of Loral Corp.
16 Maple Rd.
Chelmsford, MA 01824-3737

26742 Methode Electronics, Inc.
7447 W. Wilson Ave.
Chicago, IL 60656-4548

26806 American Zettler, Inc
75 Columbia
Aliso Viejo, CA 92656

27014 National Semiconductor
(National)
2950 San Ysidro Way
Santa Clara, CA 95051

27264 Molex Products Co.
(Molex)
5224 Katrine Ave.
Downer Grove, IL 60515

27556 IMB Electronics Prod., Inc.
(IMB)
15401 S. Carmenita Rd.
Santa Fe Springs, CA 90670

27956 Relcom
2329 Charleston Rd.
Mountain View, CA 94040

28105 Dearborn Wire and Cable Corp.
250 W. Carpenter Ave.
Wheeling, IL 60090

28480 Hewlett Packard Co. (HP)
1501 Page Mill Rd.
Palo Alto, CA 94304

28520 Heyco Prod.
Kenilnorth, NJ. 07003

28545 Alpha Components Corp.
(Alpha Comp)
4087 Glencoe Ave.
Venice, CA 20291

28564 Refac Electronics Corp.
(Refac)
West Hills Rd.
P.O. Box 809
Winsted, CT 06098-9616

28983 Daico Industries Inc.
2453 E. Del Amo Blvd.
Compton, CA 90224

29005 Storm Products Co.
(Storm)
2251 Federal Ave.
Los Angeles, CA 90064

29251 Krystinel Corp.
126 Pennsylvania Ave.
Patterson, NJ 07509

29446 Solar Screw Corp
(Kaytek)
12 Interstate Rd.
Addison, IL 60101-4510

29938 Emcon, Inc.
11620 Sorrenito Valley Rd.
P.O. Box 81542
San Diego, CA 92138

29990 American Tech. Ceramics
(ATC)
1 Nordon Ln.
Hunting Station, NY 11746

3H883 Tempus Industries
15513 Vermont Ave.
Paramount, CA 90723-4226

3N087 Mill-Max Corp
(Precidip/Millmax)
190 Pine Hallow Rd.
P.O. Box 300
Oyster Bay, NY 11771-4204

3R006 Oxley, Inc.
25 C Business Park Dr.
P.O. Box 814
Branford, CT 06405

3W023 Ferroxcube Corp.
5083 Kingshighway
Saugerties, NY 12477

3W944 Mini-Magnetics Co., Inc
1100 Fulton Pl.
Fremont, CA 94539-7077

30103 TCI/BR
Technology for Communications International
BR Communications
B&C Division
47300 Kato Road
Fremont, CA 94538

30146 Symbex Corp.
72 Corwin Dr. P.O. Box 938
Plainsville, OH 44077-1802

30161 Aavid Engineering Inc.
30 Cook Ct.
Laconia, NH 03246

30239 Techni Tool
1216 Arches St.
Philadelphia, PA 19107

30817 Instrument Specialties Co., Inc.
Broad St. P.O. Box A
Delaware Water Gap, PA 18327

30954 QT Computer Systems
(QTC)
15335 Hawthorne Blvd.
Lawndale, CA 90260-2102

31433 Kemet Electronics Corp.
P.O. Box 5928
Greenville, SC 29606

31447 Protolab
3011 Alhambra Dr.
Cameron Park, CA 95682

31514 SAE Advanced Packaging, Inc.
(SAE Adv Pack)
1357 Edinger
Santa Ana, CA 92707

31669 Pico Electronics
(Pico Elec)
316 W. First St.
Mt. Vernon, NY 10550

31734 Bondus Mfg. Co.
(Bondus)
Monticello, MN 55362

31785 Isotemp
P. O. Box 3389
Charlottesville, VA 22901

31918 ITT Shadow
8081 Wallace Rd.
Eden Prairie, MN 55344-2224

32001 Jensen Mfg.,
Division/The Muter Co.
(Jensen)
5655 W. 73rd St.
Chicago, IL 60638

32293 Intersil Memory Corp.
(Intersil)
10900 N. Tantau Ave.
Cupertino, CA 95014

32424 Elcom Systems, Inc.
932 Clint Moore Rd.
Baca Raton, FL 33431-2895

32661 TII Corp.,
Telecommunications Div.
(TII)
100 N. Strong Ave.
Lindhurst, NY 11757

32720 Airpax Electronics, Inc.,
Pacific Div.
(Airpax Pac)
1836 Floradale St.
S. El Monte, CA 91733

33095 Spectrum Control Inc.
2185 W. 8th St.
Erie, PA 16505

33783 TCI/BR
Technology for Communications International
BR Communications
BR Division
222 Caspian Drive
Sunnyvale, CA 94089

34114 Oak Electro
16935 Bernardo
Rancho Bernardo, CA
92127-1605

34333 Silicon General
11861 Western Ave.
Garden Grove, CA 92641-1816

34335 Advanced Micro Devices
(AMD)
901 Thompson Pl.
Sunnyvale, CA 94086

34371 Harris Semiconductor CMOS
Digital Products Div.
(Harris)
MS 53-035
P.O. Box 883
Melbourne, FL 32902-0883

34649 Intel Corp.
3065 Bowers Ave.
Santa Clara, CA 95051

34785 Dek Inc.
3480 Swenson Ave.
St Charles, IL 60174

34899 Fair-rite
P. O. Box J
Wallkill, NY 12589

35344 Leach Relay Div.
(Leach Relay)
5915 Avalon Blvd.
Los Angeles, CA 90003

37964 Gennum Corp.
Linear Technology Inc.
970 Fraser Dr.
P.O. Box 489
Burlington, Ontario L7R 3Y3
Canada

38086 Matrox Electronics Systems,
Ltd.
1055 St. Regis Blvd.
Dorval Que, CAN H9P 2T4

39993 Altus Corp.
1610 Crane Ct.
San Jose, CA 95112

4U402 Roederstein Electronics
2100 Front St.
Statesville, NC 28677-3651

44655 Ohmite Mfg. Co.
(Ohmite)
3601 W. Howard St.
Skokie, IL 60076

46384 Penn Engineering & Mfg. Corp.
(Penn Engr)
Old Easton Hwy.
Doylestown, PA 18901

47189 Hunter and Ready, Inc.
449 Sherman Ave.
PA 94306

47904 Poloroid Corp.
549 Technology Square
Cambridge, MA 02319-3539

49956 Raytheon Co.
(Raytheon)
141 Spring St.
Lexington, MA 02173

5W060 Olander Corp.
144 Commerical St.
Sunnyvale, CA 94086-5298

50088 Mostek Corp.
(Mostek)
1400 Upfield Dr.
Carrollton, TX 75006

50127 EPC Identification Systems
505 Martin Ave.
Rohnert Park, CA 94928

50172 Vigor Co.,
Div. of Jadow Sons, Inc.
53 W. 23rd
New York, NY 10010

50364 MMI/AMD
2175 Mission College Dr.
Santa Clara, CA 95050-1592

50522 Monsanto,
Electronic Div.
(Mono Elec)
3400 Hillview Ave.
Palo Alto, CA 90304

50579 Siemens,
Optoelectronic Div.
19000 Homestead Rd.
Cupertino, CA 95014-0712

50667 Dynatech Microwave Technology, Inc.
Dynatech Microwave Switches Div.
26655 W. Agoura Rd.
Calabasas, CA 91302-1921

50721 Datel Systems, Inc.
(Datel)
1020 Turnpike St.
Canton, MA 02021

50738 Wire-Pro Inc.
23 Front St.
Salem, NJ 08079-1067

50783 Penn-Tran Corp.
(Penn-Tran)
Rt. 144 North
P. O. Box 1321
Wingate, PA 16880

50918 Novation
18664 Oxnard St.
Tarzana, CA 91356

51406 Murata Erie N. America, Inc.
(MENA)
1148 Franklin Rd. S.E.
Marietta, GA 30067

51705 ICO Rally Corp.
(ICO Rally)
2575 E. Bayshore Rd.
Palo Alto, CA 94303

51791 Statek Corp.
(Statek)
512 N. Main St.
Orange, CA 92668

52063 Exar Integrated Systems, Inc.
(Exar)
2222 Qume Dr.
P.O. Box 49007
San Jose, CA 95161-9007

52072 Circuit Assembly Corp.
18 Thomas St.
Irvine, CA 92718-2703

52094 Calmark Corp.
4915 Walnut Grove Ave.
San Garbriel, CA 91776-2021

52458 Magnum Electric Corp.
(Magnum)
6385 Dixie Hwy.
Erie, MI 48133

52648 Plessey Trading Corp.
Plessey Optoelectronics and Microwave
Irvine, CA

52700 Tech Form Labs
2021 N. Glassett St.
Orange, CA 92665

53217 Technical Wire Products (Tecknit)
320 Nopal St.
Santa Barbara, CA 93103-3225

53387 Minnesota Mining and Manufacturing Co.
Electronic Products Div.
11550 Stonehollow Dr.
P.O. Box 2963
Austin, TX 78769-2963

53317 Control Sciences Inc.
9601-1 Owensmouth Ave.
Chatsworth, CA 91311

53414 Racal Vadic
222 Caspian Dr.
Sunnyvale, CA 94086

53421 Tyton Corp.
2300 W. Florist Ave.
Milwaukee, WI 53209

53719 L. H. Research
(LH)
14402 Franklin Ave.
Tustin, CA 92680

53733 Filtronics Inc.
6010 Paretta Dr.
Kansas City, MO 64120-1338

53763 International Devices
(Intrnl Dev)
326 Pendelton
Santa Ana, CA 92704

53848 Standard Microsystems Corp.
(SMC)
35 Marcus Blvd.
Hauppauge, NY 11787

53894 Aham, Inc.
27901 Front St.
Rancho, CA 92390

54294 Shallcross Inc.
US 70 East
Smithfield, NC 27577

54972 Clinton Electronics Corp.
(Clinton Elec)
6701 Clinton Rd.
Rockford, IL 61111

55026 Simpson Electronic Co.
Div. of American Gage & Machine Co.
(Simpson)
5200 W. Kinzie St.
Chicago, IL 60644

55300 Interface Products, Inc.
2185 S. Grand
Santa Ana, CA 92705

55322 Samtec Inc.
810 Progress Blvd.
P.O. Box 1147
New Albany, IN 47150-2257

55566 RAF Electronic Hrdwr Inc.
(RAF)
95 Silvermine Rd.
Seymour, CT 06483

55840 Eaton Corp.,
Commercial Controls Div.
4201 N. 27th St.
Milwaukee, WI 53216

56289 Sprague Electric Co.
(Sprague)
North Adams, MA 02147

56501 Thomas & Betts Corp.,
Ansley Electronics Div.
(T & B Ansley)
920 Rt. 202
Raritan, NJ 08869

56845 Dale Electronics, Inc.
(Dale Elec)
Box 74
Norfolk, NE 68701

57053 Gates Energy Products
(Gates)
1050 S. Broadway
Denver, CO 80217

57177 Promptus
25332 Marbonne Ave. #160
Lomita, CA 90717

57474 Hytek Microsystems Inc.
(Hytek)
980 University
Los Gatos, CA 95030-2315

57693 Oscillatek Corp.
620 N. Lindenwood Dr.
Olathe, KS 66062-1276

57775 The Advanced Group
(Adv Elect)
1661 Industrial Way
Belmont, CA 94002

57962 Thomson Microelectronics Inc.
(Thomson-Mostek)
16 Commerce Dr.
Montgomeryville, PA 18936

58361 Monsanto,
Div. of General Instrument
(Mon Gen Inst)
3400 Hillview
Palo Alto, CA 94303

59270 Selco Products Inc.
(Seleco)
7580 Stage Rd.
Buena Park, CA 90621-1224

59474 Jeffers Electronics Inc.
3965 Fairway Dr.
Nogales, AZ 85621-2216

59532 Cubic Communications Inc.
Division of Cubic Corp.
305 Airport Rd.
Oceanside, CA 92054-1297

59604 Supertex Inc.
1225 Bordeaux Dr.
Sunnyvale, CA 94086

59660 Tusonix Inc.
2155 N. Forbes Blvd.
Suite 1071108
Tucson, AZ 85745

59723 Porcelain Products Inc.
225 N. Patterson
Carey, OH 43316-1053

59993 International Rectifier
Semiconductor Div.
(IR)
233 Kansas St.
El Segundo, CA 90245-4316

6E390 Powell Electronics
2260 Lundy Ave.
San Jose, CA 95131-1816

6E696 TCI/BR
Technology for Communications International
BR Communications
ISD Division
47300 Kato Road
Fremont, CA 94538

6M235 Electrical Wire Products
Bay Associates
150 Jefferson Dr.
Menlo Park, CA 94025-1115

6T332 Hoffman Industrial Products
73 Orville Dr.
Bohemia, NY 11716

6Y440 Micron Technology, Inc.
2805 E. Columbia Rd.
Boise, ID 83706

6Z415 Bryant Electric Co.
Div. of Westinghouse Electric
1718 W. Fullerton Ave.
Chicago, IL 60614-1922

6Z833 Amkey
220 Ballardvail St.
Wilmington, MA 01887

60382 TDJ Co.
1152 Morena Blvd.
San Diego, CA 92110

60395 Xicor
851 Buckeye Ct.
Milpitas, CA 95035

60741 Triplett Corp.
(Triplett)
286 Harmon Rd.
Bluffton, OH 45817

61081 Electronic Solutions, Inc.
(ESI)
5780 Chesapeake Ct.
San Diego, CA 92123

61114 Polyphaser Corp.
(Plyphsr Crp)
1500 W. Wind Blvd.
Kissimee, FL 32741

61362 Stanford
Telecommunications, Inc.
2421 Mission College Blvd.
Santa Clara, CA 95054-1298

61394 Seeq Technology
1849 Fortune Dr.
San Jose, CA 95131-1724

61529 Aromat Corp.
250 Sheffield St.
Mountainside, NY 07092

61638 Advanced Interconnections
Corp.
5 Energy Way
P.O. Box 1342
West Warwick, RI 02893

61655 Micronel
2142 Industrial Ct.
Vista, CA 90283

61725 ITT Components
(ITT Comp)
3201 Standard St.
Santa Ana, CA 92707

61772 Integrated Devices Tech.
(IDT)
3236 Scott Blvd.
Santa Clara, CA 95051

61802 Toshiba International,
Industrial Div.
(Toshiba)
13131 W. Little N.Y. Rd.
P.O. Box 40906
Houston, TX 77041

61874 Eckardt
691 N. Main St.
Orange, CA 92668

61892 NEC Electronics USA, Inc.,
Microcomputer Div.
(NEC)
1 Natick Exuc. Pk
Natick, MA 01760

61935 Schurter, Inc.
(Schurter)
1016 Clegg
Petaluma, CA 94952

61951 Micro Lamps, Inc.
1530 Hubbard Ave.
Batavia, IL 60510-1420

62060 Lockwell Prod. Co.
Div. of Hartell Corp.
701 Foothill Blvd.
Azusa, CA 91702

62104 California Eastern Labs
4590 Patrick Henry Dr.
Santa Clara, CA 95054-3309

62132 Manhattan Electric Cable Corp.
400 Willow St.

Bridgeton, NJ 08302

62165 Joslyn Defense Systems, Inc.
(Arrowsmith)
2085 Shelburne Rd.
Shelburne, VT 05462

62483 Densitron Development, Inc.
2540 W. 237th St.
Torrance, CA 90505

62530 Pacer Technology
1600 Dell Ave.
Campbell, CA 95008

62643 United Chemicon Inc.
9806 Higgins St.
Rosemont, IL 60018-4792

62786 Hitachi America
(Hitachi)
1800 Bering Dr.
San Jose, CA 95122

63237 Brooks Mfgr. Corp.
3147-53 Emerald St.
Philadelphia, PA 19134

64013 Elna America, Inc.
153 E. Savarona Way,
Carson, CA 90746-1406

64409 Diversified Technology, Inc.
Sub of Ergon Co.
112 E. State St.
P.O. Box 478
Ridgeland, MS 39159

64443 Metacomp Inc.
(Metacomp)
7290 Engineer Rd. Suite F
San Diego, CA 92111

65632 AAR Hardware
2100 Touhey Ave.
Elk Grove Village,
IL 60007-5325

65786 Cypress Semiconductor, Inc.
3901 N. First St.
San Jose, CA 95134-1506

66419 Exel Microelectronics, Inc.
2150 Commerce Dr.
San Jose, CA 95131

66958 SGS-Thomson,
Microelectronics, Inc.
1000 E. Bell Rd.
Phoenix, AZ 85022-2649

67183 Altera Corp.
2610 Orchard Pky.
San Jose, CA 95134-2020

69345 Energy Transformation Systems
2663 Fair Oaks Ave.
Redwood City, CA 94063

7G902 Textron Inc.
Camcar Div.
(Camcar)
600 18th Ave.
Rockford, IL 61101

7N961 Permacel
Richmond, VA

70106 Acushnet Co.
744 Belleville
P.O. Box E916
New Bedford, MA 02742-0916

70318 Allmetal Screw Products, Inc.
(Allmetal)
821 Stewart Ave.
Garden City, NY 11530

70472 Associated Spring Corp.
(Assoc Spring)
18-30 Main St.
Bristol, CT 06010

70892 Bead Chain Mfg. Co.
110 Mountain Grove St.
P.O. Box K
Bridgeport, CT 06605-2120

70903 Belden Corp.
(Belden)
415 S. Kilpatrick
Chicago, IL 60644

70998 Bird Electronic Corp.
(Bird Elec)
30303 Aurora Rd.
Cleveland, OH 44139

71279 Interconnection Products Inc.
2601 Garnsey St.
Santa Ana, CA 92707

71400 Bussman Mfg.,
Div. of McGraw Edison Co.
(Bussman)
2536 W. University St.
St. Louis, MO 63017

71450 CTS Corp.
(CTS)
905 N. West Blvd.
Elkhart, IN

71468 ITT Cannon Electric
(ITT)
666 E. Dryer Rd.
Santa Ana, CA 92705

71482 General Instr. Corp.,
Clare Div.
(Clare)
3101 W Pratt Blvd.
Chicago, IL 60695

71590 CRL Components Inc.
Hwy 20 W
P.O. Box 858
Ft. Dodge, IA 50501

71643 CHR Industries, Inc.
An Armco Co.ßœ
407 East St.
New Haven, CT 06509

71744 Chicago Miniature Lamp
Works
(Chicago Min)
4433 Ravenswood Ave.
Chicago, IL 60640

71950 Centralab Elec Div.
5757 N. Green Bay Ave.
Milwaukee, WI 53201

71984 Dow Corning Corp.
(Dow Corning)
S. Saginaw Rd.
Midland, MI 48641

72259 Nytronics, Inc.
(Nytronics)
10 Pelham Parkway
Pelham Manor, NY 10803

72619 Dialight Corp.
(Dialight)
60 Steward Ave.
Brooklyn, NY 11237

72653 G. C. Electronics Co.,
A Div. of Hydrometals, Inc.
(GC Elec)
400 S. Wyman St.
Rockford, IL 61101

72656 Indiana General Corp.,
Electronics Div.
(Indiana)
Crows Mill Rd.
Keasby, NY 08832

72794 Dzus Fastener Co.
(Dzus)
425 Union Blvd.
West Islip, NY 11795

72819 Carburandum Inc.
P. O. Box 339
Niagra Falls, NY 14302

72982 Erie Technological Products,
Inc.
(Erie Tech)
644 W. 12th St.

Erie, PA 16512

72983 Essex Group Inc.
1601 Wall St.
P.O. Box 1601
Fort Wayne, IN 46801-1601

73138 Beckman Instruments, Inc.,
Helipot Div.
(Beckman)
2500 Harbor Blvd.
Fullerton, CA 92634

73612 Consolidated
Electronic Wire and Cable
11044 King
Franklin Park, IL 60131

73899 J. F. D. Electronic, NY
12771

73905 Lear Siegler Inc.
Jennings Div.
(ITT Jennings)
970 McLaughlin
San Jose, CA 95122-2611

73920 Kerrigan-Lewis Mfg. Co.
4421 W. Rice St.
Chicago, IL 60651-3457

73957 Groov-Pin Corp.
1125 Hendricks Causeway
Ridgefield, NJ 07657

74193 Heineman Electric Co.
Brunswick PK-ALT
Rt. No 1 P.O. Box 6800
Lawrenceville, NJ 0864

74199 Quam Nichols Co.
218 E. Marquette Rd.
Chicago, IL 60637-4031

74284 Brooks and Perkins, Inc.
Skydyne Unit
PO Box 1106
Pt. Jervis, NY 12771-9504

74545 Harvey Hubbell, Inc.
(Hubbell)
State St. & Bostwick Ave.
Bridgeport, CT 06602

74829 Ilsco Corp.
4730 Madison Rd.
Cincinnati, OH 45227-1426

74868 Amphenol Corp.
RF Microwave Div.
1 Kennedy Ave.
Danbury, CT 06810-5803

74970 E. F. Johnson Co.
(EF Johnson)
299 S. W. 10th Ave.
Wacesa, MN 56093

75037 Minnesota Mining & Mfg. Co.,
Electro Products Div.
(3M)
3M Center St.
St. Paul, MN 55101

75042 IRC Div. of TRW, Inc.
(IRC)
401 Broad St.
Philadelphia, PA 19108

75378 CTS Knights, Inc.
400 Reinmann Ave.
Sandwich, IL 60548-1846

75382 Kulka Electronic Co.
(Kulka Elec)
520 S. Fulton Ave.
Mt. Vernon, NY 10550

75915 Littelfuse, Inc.
(Littelfuse)
800 E. Northwest Hwy.
Des Plaines, IL 60016

76190 Markely Electronic Supply
Harrisburg, PA

76385 Minor Rubber Co., Inc.
49 Ackerman St.
Bloomfield, NJ 07003

76493 Bell Industries Inc.
Miller Div.
19070 Reyes Ave.
P.O. Box 5825
Compton, CA 90224-5825

76854 Oak Switch Systems, Inc.
100 S. Main St.
Crystal Lake, IL 60014-6201

77638 General Instruments Corp.,
Rectifier Div.
(Gen Instr)
240 Wythe Ave.
Brooklyn, NY 11229

77820 Bendix Corp.,
Electrical Components Div.
(Bendix)
Sherman Ave.
Sidney, NY 13838

77824 Schlegel Corp.
1555 Jefferson Rd.
Rochester, NY 14692-3113

77969 Rubbercraft Corp. of California
Ltd.
15627 S. Broadway
Gardena, CA 90248

79756 Alatec Products
45445 Warm Springs Blvd.
Fremont, CA 94539-6104

79930 Easco Aluminum Corp.
(Easco)
3786 Oakwaood Ave.
Youngstown, OH 44509

79963 Zierick Mfg. Co.
(Zierick)
Radio Circle
Kisco, NY 10549

8P971 Modpak
Div. of Adams-Russell Co.
80 Cambridge,
Burlington, MA 01803-4107

8V335 Litton Systems Inc.
Sub of Litton Industries
100 New Woods Rd.
Watertown, CT 06795-3339

8X652 Jensen Sound Labs
4136 N. United Pkwy.
Schiller Park, IL 60176-1708

80009 Tektronics
P. O. Box 500
Beaverton, OR 97099

80031 Mepco/Electra Inc.
2001 W. Blue Heron Blvd.
PO Box 10330
Riviera Beach, FL 33404

80089 Stancor Products
131 Godfrey St.
Logansport, IN 46947

80103 Lambda Electronics Corp.
(Lambada Elec)
515 Broad Hallow Rd.
Huntington, NY 11749

80294 Bourns, Inc.,
Trimpot Div.
(Bourns)
1200 Columbia Ave.
Riverside, CA 92507

80813 Dimco-Gray Co.
8200 Suburban Rd.
Centerville, OH 45459

81073 Grayhill, Inc.
(Grayhill)
561 Hillgrove Ave.
La Grange, IL 60525

81095 Triad Transformer Corp.
(Triad)
4055 Redwood Ave.
Venice, CA 90293

81483 International Rectifier Corp.
(Intrnl Rect)
9220 Sunset Blvd.
Los Angeles, CA 90060

81541 Airpax Electronics, Inc.
(Airpax)
Woods Rd.
Cambridge, MD 21631

82219 Philips ESG Inc.
Div. of North American Philips
West Third St.
Emporium, PA 15834

82239 Sigma Instruments, Inc.
Shurite Instruments Div.
Orange Ct.
New Haven, CT 51670

82389 Switchcraft, Inc.
(Switchcraft)
5555 N. Elston Ave.
Chicago, IL 60630

82692 Mackay Communications, Inc.
4901 North Beach Blvd.
P.O. Box 58649
Raleigh, NC 27604

82851 National Mfg. Co.
First Ave.
Sterling, IL 61081

82877 Rotron, Inc.
(Rotron)
7-9 Hasbrouck Ln.
Woodstock, NY 12498

83186 Victory Engineering Corp.
(Victory Engr)
Victory Rd.
Springfield, NJ 07081

83259 Parker-Hannifin Corp.
Seals Group
O-Seal Division
10567 Jeffereson Blvd.
Culver City, CA 90232-3513

83817 Dynamics Corp. of America
Reeves-Hoffman Div.
400 W. North St.
Carlisle, PA 17013-2248

83330 Smith, Herman H., Inc.
(HH Smith)
812 Snediker Ave.
Brooklyn, NY 11207

83701 Electronic Devices Inc.
(EDI)
21 Gray Oaks Ave.
Yonkers, NY 10710

83740 Eveready Battery Co., Inc.
Checkerboard Square
St Louis, MO 63164

83817 Dynamics Corp. of America
Reeves-Hoffman Div.
400 W. North St.
Carlisle, PA 17013-2248

84171 Arco Electronics, Inc.
(Arco Elec)
Community Dr.
Great Neck, NY 11022

84337 General Insulated Wire Works
New York, NY 10017

84411 TRW Capacitor Div.
(TRW Cap)
112 W. First St.
Ogallala, NE 69153

84830 Lee Spring Co., Inc.
30 Main St.
Brooklyn, NY 11201

85471 Boyd Ind. Rubber Div.
13885 Ramona Ave.
Chino, CA 91710

85480 W.H. Brady
Industrial Products Div.
2221 W. Camden Rd.
P.O. Box 2131
Milwaukee, WI 53201

86684 RCA Corp.,
Electronic Components
(RCA Elec)
415 S. 5th St.
Harrison, NJ 07029

86928 Seastrom Mfg. Co., Inc.
701 Sondra Ave.
Glendale, CA 91201-2431

87034 Marco Oak Ind., Inc.
(Marco Oak)
P. O. Box 4011
207 S. Helena
Anaheim, CA 92803

88245 Litton Ind.,
USECO Div.
(USECO)
13536 Saticoy St.
Van Nuys, CA 91409

89265 Potter & Brumfield Inc.
A Siemens Co.
200 S. Richland Creek Dr.
Princeton, IN 47671

9F082 Stanley Electric Mfg. Co.
Atlanta, GA

9Z397 Fujitsu Components of
America, Inc.
3320 Scott Blvd.
Santa Clara, 95054-3101

90201 Mallory Capacitor Co.
(Mallory Cap)
3029 E. Washington St.
P. O. Box 372
Indianapolis, IN 46206

91506 Augat, Inc.
(Augat)
33 Perry Ave.
Attleboro, MA 02703

91637 Dale Electronics, Inc.
(Dale Elec)
P. O. Box 609
Columbus, NE 68601-3632

91662 Elco Corp.
Connector Div.
Huntingdon Industrial Park
Huntingdon, PA 16652

91833 Keystone Electronics Corp.
(Keystone)
49 Bleecker St.
New York, NY 10012

91836 Kings Electronics Co., Inc.
(Kings Elec)
40 Marbledale Rd.
Tuckahoe, NY 10707

91929 Honeywell, Inc.,
Building Controls & Components,
Group Micro Switch Div.
(Honeywell)
11 W. Spring St.
Freeport, IL 61032

92272 Jerome Electric Corp.,
Div. of Jerome Ind.
(Jerome)
391 Lakeside Ave.
Orange, NJ 07050

94222 Southco, Inc.
(Southco)
Lester, PA 19ll3

94292 Standard Grigsby
88N Duggan
Sugar Grove, IL 60554

94312 National Moldite Co., Inc.
250 South St.
Newark, NJ 07119

94867 Churchill Corp.
(Churchill)
344 Franklin St.
Melrose, MA 02176

94987 Cubic Corp.
9233 Balboa Ave.
San Diego, CA 92123

95105 Rockwell Collins
Cedar Rapids, IA 52406

95146 Alco Electronic Products
(Alco)
1551 Osgood St.
N. Andover, MA 01845

95566 Arnold Engineering
(Arnold Engr)
P. O. Box G
Mareno, IL 60152

96195 Unistrut Corp.
777 E. Eisehnower Pkwy.
Ann Arbor, MI 48108

96256 Thordarson-Meissner Inc.
Sub of Components Corp. of America
628 Belmont St.
Mt. Carmel, IL 62863

96336 Ensign-Bickford Aerospace Co.
640 Hopmeadow St.
P.O. Box 427
Simsbury, CT 06070-2420

96341 Microwave Associates Inc.,
Sub of M/A Com Inc.
2nd Ave., Bldg 21
Burlington, MA 01803

96733 SFE Technologies
(SFE Techn)
15101 1st St.
San Fernando, CA 91341

96906 Military Standard Promulgated
by Standardization Div.
Directorate of Logisitic Services
(Mil Std)
DSA

97137 TRW Electrical
Components Div.
Chicago, IL

97539 Amp-Hexseal Corp.
44 Honeck St.
Englewood, NJ 07631-4134

98003 Nielson Hardware Corp.
770 Wethersfield Ave.
P.O. Box 568
Hartford, CT 06141

98291 Sealectro Corp.,
(Sealectro)
225 Hoyt
Mamoronek, NY 10544

98376 Zero (West)
777 W. Front St.
Burbank, CA 91503

98587 Amco Engineering Co.
3801 N. Rose St.
Schiller Park, IL 60176

98821 North Hills Electronics, Inc.
Alexander Pl.
Glen Cove, NY 11542-3704

99256 Pem Engineering, Inc.
(Pem Engr)
Los Angeles, CA 90064

APPENDIX A - PARTS LISTS

Part No.	Title
8174-1503-03-031, Rev. L	Unit, HF Monitor Receiver (3 Sheets)
8174-1561-63-031, Rev. D	Unit, HF Monitor Receiver (2 Sheets)
8174-1603-03-061, Rev. K	Unit, HF Monitor Receiver (2 Sheets)
8174-1603-04-061, Rev. L	Unit, HF Monitor Receiver (2 Sheets)
8074-2004-103, Rev. F	Assy, PCB CPU/DSP (3 Sheets)
8074-2004-104, Rev. F	Assy, PCB CPU/DSP (3 Sheets)
8074-2004-163, Rev. C	Assy, PCB CPU/DSP (3 Sheets)
8074-2105-101, Rev. F	Assy, PCB Synthesizer 100 PPM
8074-2105-103, Rev. F	Assy, PCB Synthesizer 1 PPM
8074-2105-161, Rev. B	Assy, PCB Synthesizer 100 PPM
8074-2105-XX, Rev. N	Common Parts, Synthesizer PCB (3 Sheets)
8174-2001-01, Rev. B	Assy, PCB DC Power Filter
8174-2005-XX, Rev. D	Common Parts, Synthesizer PCB (5 Sheets)
8400-2006-103, Rev. Y	Assy, PCB Receiver (4 Sheets)
8400-2006-106, Rev. V	Assy, PCB Receiver Low Frequency 8174 (5 Sheets)
8174-1901-01, Rev. C	Assy, Cable Receiver/CPU/Synthesizer

APPENDIX B - WIRE LISTS

Part No.	Title
8174-1503, Rev. F	8174Receiver

APPENDIX C - ASSEMBLY DRAWINGS

Drawing No.	Title
8174-1503, Rev. M	Unit, HF Monitor Receiver (4 Sheets)
8174-0909, Rev. C	8174 Digital HF Receiver (2 Sheets)
8174-1901-01, Rev. C	Cable Assembly Receiver/CPU/Synthesizer (1 sheet)

APPENDIX D - ELECTRICAL DRAWINGS

BLOCK DIAGRAMS

Drawing No.	Title
8074-0808, Rev. A	Block Diagram, DSP Demodulation (6 Sheets)
8400-4206, Rev. A	Block Diagram, HF DF Receiver (2 Sheets)
8074-4205, Rev. A	Block Diagram, Synthesizer (1 sheet)
8074-4204-01, Rev. A	Block Diagram, CPU/DSP (1 sheet)

SCHEMATIC DIAGRAMS

Drawing No.	Title
8074-5004-103, Rev. C	Schematic Diagram, CPU/DSP (18 Sheets)
8074-5004-104, Rev. B	Schematic Diagram, CPU/DSP (18 Sheets)
8074-5005, Rev. H	Schematic Diagram, Synthesizer (10 Sheets)
8074-5105, Rev. J	Schematic Diagram, Synthesizer (10 Sheets)
8174-5001, Rev. B	Schematic Diagram, DC Power Filter (1 sheet)
8400-5006, Rev. T	Schematic Diagram, Receiver (10 Sheets)

APPENDIX E – MODEL 8074/8174 VIRTUAL CONTROL PANEL OPERATING MANUAL

0040-8074-15003